SAN FRANCISCO WASTEWATER PROGRAM

CITY AND COUNTY OF SAN FRANCISCO

WESTSIDE WET WEATHER FACILITIES REVISED OVERFLOW CONTROL STUDY

Abstract Report and Request for Revised Overflow Frequency

DECEMBER 1978

TABLE OF CONTENTS

SAN FRANCISCO WASTEWATER PROGRAM

City and County of San Francisco, 150 Hayes Street, San Francisco, California 94102, Telephone (415) 558-2137

December 15, 1978

Regional Water Quality
Control Board
1111 Jackson Street
Oakland, California 94607

WESTSIDE WET WEATHER FACILITIES
REVISED OVERFLOW FREQUENCY

Ladies and Gentlemen:

The City and County of San Francisco has been designing its wet-weather facilities under existing RWQCB Orders #76-22, #76-23, and #76-24, which established in 1976 specific numbers of wet-weather combined sewer overflows for the Southeast, Westside, and North Shore zones respectively. These permits allow for an average of one to four overflows City-wide but for Westside, specifically, only one overflow is allowed. On November 28, 1978, the City requested and the Regional Water Quality Control Board granted, a revised overflow frequency level for the Northshore by amending Order No. 76-24 to provide an average of four overflows per year.

The purpose of this letter is to petition the Regional Board to amend RWQCB Order #76-23 (the Westside Zone) to allow an average of eight wet-weather combined sewage overflows per year for the Westside.

Currently, the Westside is permitted only one overflow annually. The Regional Board Orders require the City, if it requests a revision on overflow frequencies, to develop and submit the information that could form the basis of Board amending action. The City has recently developed this information primarily through work currently in progress for the Southwest Water Pollution Control Plant Facility Plan, including the Environmental Impact Report for that facility. Additional data has been gathered by the City staff, some of which is included in this report and some of which will be submitted during the coming weeks as it is refined.

The City is petitioning the Regional Board for eight overflows on the Westside at this time for the following reasons:

1. The State Water Quality Control Board is urging the City to award the Westside contracts as rapidly as possible. In order to proceed with advertising the control level must be established. Each month's delay causes an inflationary cost of approximately 1.5 million dollars per month.

2. The California Coastal Commission has denied the City a required development permit based on one overflow along the Great Highway in part because of concern for the size/location of the transport necessary for a 1 overflow system. Key to developing a new permit application is the selection of a final alignment for Westside facilities, for which a decision on overflow frequencies is required. Only after the alignment is established can the City proceed to obtain the Coastal Commission Permit necessary to construct the facilities.

3. The Citizens of San Francisco have become extremely sensitive to the tremendous increases to the sewer service charge and are demanding that Wastewater quality be improved at a substantially reduced cost level than the current NPDES permit allows. The 1977 amendment to the Federal Clean Water Act parallels citizen concern on this point and underscores the need to consider cost-effectiveness of Wastewater plans.

While the petition before the Regional Board now is for a reduction in overflows for Westside only, Westside is only one component of the entire City-wide waste water system. To understand the full extent of the potential cost benefits to San Francisco of reduced overflows, the City is providing the Regional Board with updated information pertinent to the City-wide system as well as to the Westside. This will assist the Board in making sound judgments regarding costs vs water quality benefits, judgments which are of concern to all governmental agencies and citizens.

The bulk of the data relevant to an overflow frequency decision is included in this Abstract Report delivered, as requested by the RWQCB staff, on December 15. Additional information addressing primarily Public Health & Fish & Game concerns, as well as refined financial data will be forwarded to the Board during the coming weeks to assist in the determination.

The information is submitted on eight plates and a back-up report as follows:

Plate 1: City Map Delineating the Westside Zone.
Plate 2: City-wide - Overflows vs Capital and Annual Cost Vs Accomplishments.
Plate 3: Tabulation of Base Data.
Plate 4: Westside Zone - Wastewater Generated and Percentage Treated.
Plate 5: Westside Zone - Tabulation/Overflows vs Accomplishments.
Plate 6: Westside Zone - Distribution of Estimated Daily Beach Users.

Plate 7: Westside - Cost Benefit Analysis Based on Recreational Beneficiaries.
Plate 8: Westside - Statistical Summary Wet Weather Overflows

Abstract Report: Westside Wet Weather Facilities Revised Overflow Control Study.

Plate 1: Delineates the Westside Zone.
Plate 2: Compares the cost benefit effect of various overflow levels City-wide. This plate contains updated values from those presented in the North Shore report, and demonstrates that the shift from the earlier NPDES overflow level to four (4) overflows effectuates a savings of $80 million in capital costs and $6 million in annual costs (ammortization and maintenance and operation costs) while increasing the overflow hours by only 3%, mass emissions by only 3% for suspended solids and 2% for BOD.
Plate 3: Is the base data used for the above Plate 2.
Plate 4: Addresses Westside specifically and identifies the amount of dry and wet-weather flow generated and treated.
Plate 5: Compares the differences between the existing NPDES requirements and a requirement of eight (8) overflows for the westside along the lines of cost vs benefits including mass emission and coliform reduction and hours of overflow. It is noted that there is a $110 million capital cost-savings, equivalent to a $10 million annual cost-saving at a slight reduction in benefits. The NPDES level of control reduces wet-weather mass emissions from existing conditions by 98%. A control level of eight (8) overflows per year reduces wet-weather mass emissions from existing conditions by 84%. This difference constitutes a reduction of only 14%. The differences in percent reductions for coliform and for hours of overflow are in the same order of magnitude, ranging from 8 to 18 percent.
Plate 6: Show beach usage for the Westside Zone. The plate shows the (estimate) number of people engaged in various beach activities such as swimming and fishing along the shoreline from Thornton Beach State Park to the Golden Gate Bridge.
Plate 7: Shows dollar costs related to additional person exposure based on probability of rainfall and overflow. It is estimated that on a typical day following overflow, approximately 2,500 people would be in and near the water, but only 165 of them would actually swim, surf, or wading above waist deep. There are approximately 21

additional days of high coliform levels between the 1 and 8 overflows levels. The annual cost aspect of increased exposure due to an increased overflow level from 1 to 8 per year is as follows:

Wading and Swimming

$10,000,000 (annual cost differential)

$165 x 21 (people/day) x 21 (days differential) = $2,886. It costs the Sewer Service Charge users $2,886 more per person swimming at the one (1) overflow than at the eight (8) overflow level.

In or Near the Water

$10,000,000 (annual cost differential)

2,500 x 21 (people/day) x 21 (days differential = $190. It cost the Sewer Service Charge users $190 more per person on the beach at the one (1) overflow level than at the eight (8) overflow level.

Plate 8: Presents comprehensive data requested by the staff of the Regional Board. This Plate provides detail and confirmation of the data summarized above.

In addition to providing statistical data covering costs and benefits of different levels of overflows, it should be further noted that the Director of the Bureau of Disease Control of the City of San Francisco states that there have been no reported cases of illness from sewage discharge in the City of San Francisco during the past 25 years. Although major infectious diseases are water-borne, there has been no definite link established between occurrence of disease and the use of beaches during overflows.

Finally, it should be noted that the overflows which will occur in the future will be of better quality water than those which presently occur. The raw mass emission data tabulated in the detailed report does not reflect the fact that material which will overflow will have been stored for a considerable time, allowing settlement of a portion of the pollutants. Model tests indicate that the proposed baffling devices will reduce floatable material in the overflows by as much as 75%.

Additional mitigating measures such as screening and outfall extensions could be taken in the future if required and shown to be cost-effective. It is prudent to construct and operate the facilities before determining if such additional mitigating measures are warranted.

In summary, the City respectfully requests the Regional Board to increase the number of allowable overflows for Westside from the present NPDES level of one (1) to a new level of eight (8). The City views this increase in allowable overflows as an environmentally sound and prudent way to serve the citizens of San Francisco and the Bay Area. It provides large capital and maintenance savings at only a slight reduction in water quality. The data generated by the City addresses in a comparative fashion for one (1) and eight (8) overflows for Westside, beach use, public health concerns, fish & game concerns, operation and maintenance costs, capital costs, and water quality. It sets the Westside permit request into the context of City-wide potential economies. The City believes that the present permit request is consistent with the Regional Board's desires for high water quality standards.

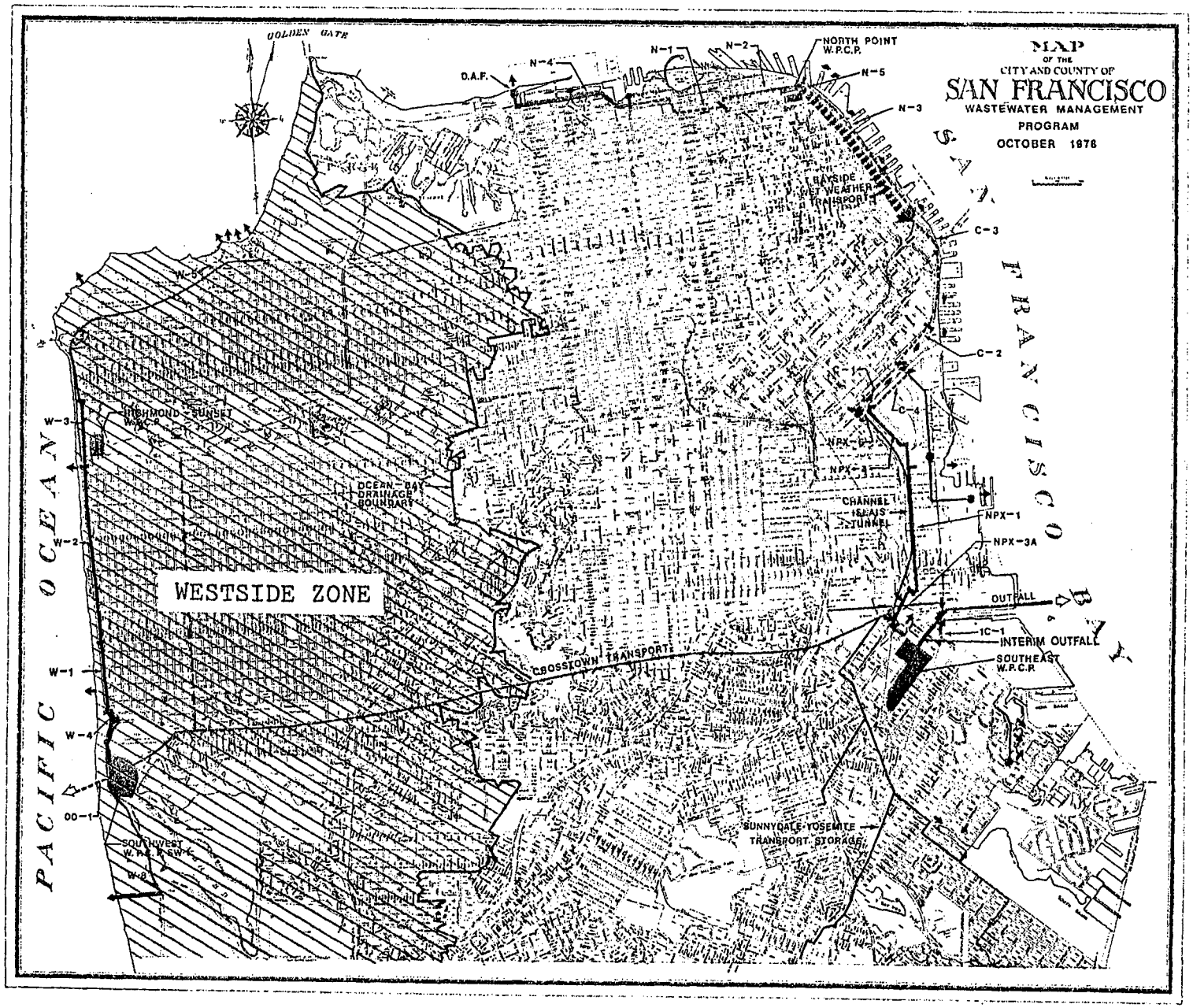
Mr. Sklar and other staff members will be in attendance at the Regional Board's meeting on January 16, 1979 to make a brief presentation. If there are any questions in the meantime, please contact me at 558-2137.

Very truly yours,

Thomas L Sanders

for A. O. Friedland
Deputy Director
Wastewater Program

REFERENCE PLATES



LEGEND

- UNDER DESIGN
- DESIGNED
- UNDER CONSTRUCTION
- CONSTRUCTED
- TENTATIVE CONCEPTS*
- ALTERNATE TENTATIVE CONCEPTS*
- OUTFALLS
- PUMPING STATION

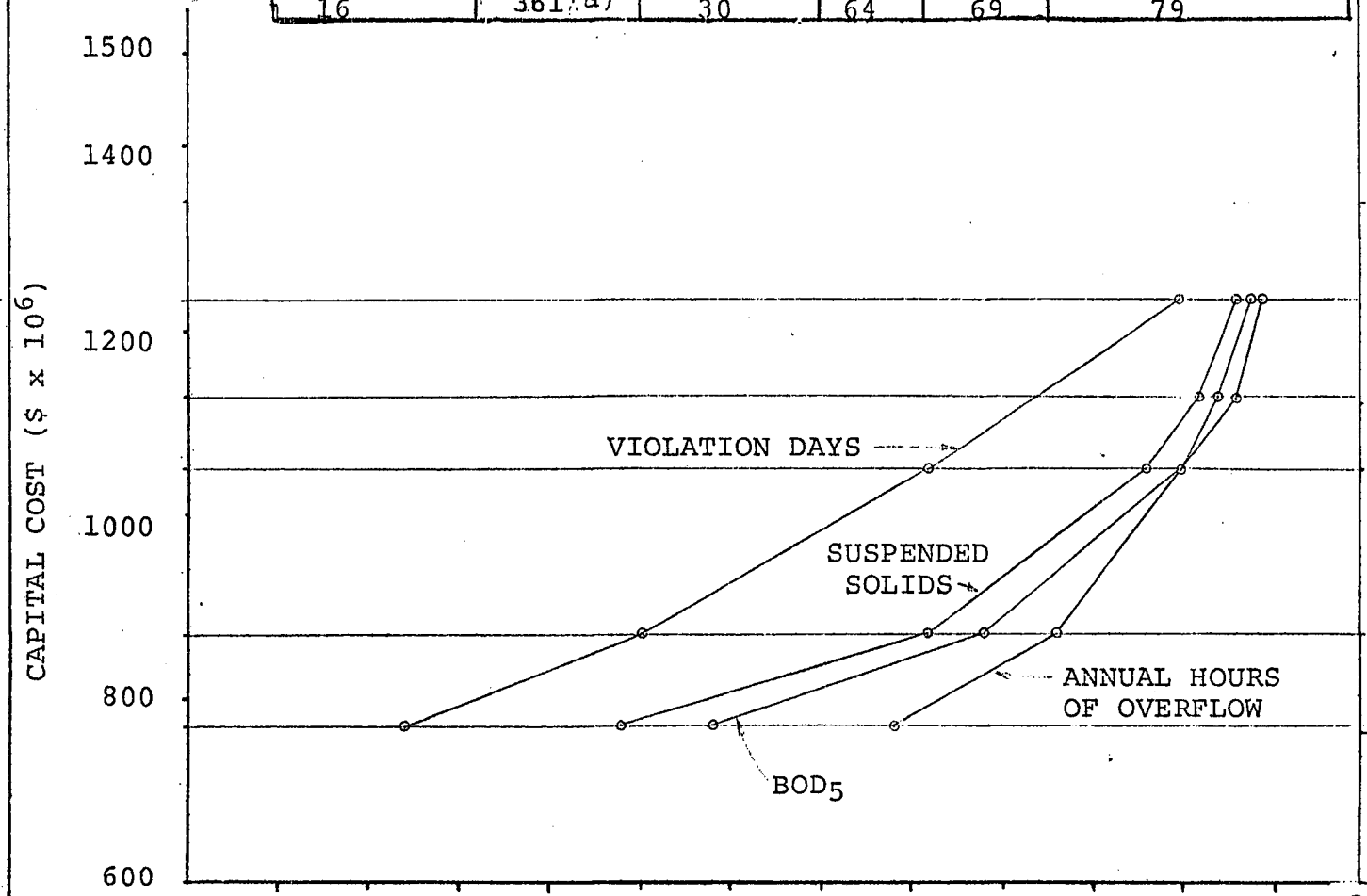
MAP REF.	PROPOSED CONSTRUCTION CONTRACTS AND SUPPORTING DOCUMENTS
	NORTH POINT CROSSTOWN
NPX-1	INDIANA STREET FORCE MAIN
NPX-3A	FORCE MAIN EVANS TO ARMY
NPX-3B	FORCE MAIN
NPX-4	FORCE MAIN, PUMP STATION TO INDIANA
NPX-6	CHANNEL PUMP STATION
NPX-6A	FORCE MAIN, PUMP STATION TO HOWARD
	NORTH SHORE OUTFALLS CONSOLIDATION
N-1	FORT MASON TUNNEL
N-2	NORTH POINT STREET
N-3	NORTH EMBARCADERO
N-4	MARINA
N-5	NORTH SHORE PUMP STATION
	CHANNEL OUTFALL CONSOLIDATION
C-1	BERRY
C-2	KING
C-3	SOUTH EMBARCADERO
C-4	SOUTH SIDE
	ISLAIS CREEK OUTFALLS CONSOLIDATION
IC-1	ISLAIS CREEK SOUTH SIDE
	WEST SIDE TRANSPORT
W-1	PUMP STA. TO SANTIAGO
W-1	SANTIAGO TO NORIEGA
W-2	NORIEGA TO LINCOLN
W-3	LINCOLN TO FULTON
W-4	WST PUMP STA. & F.M.
W-5	RICHMOND TRANSPORT
W-8	LAKE MERCED TRANSPORT (TUNNEL)
OO-1	S.W. OCEAN OUTFALL
SE-4	S.E. WATER POLLUTION CONTROL PLANT
SW-1	S.W. WATER POLLUTION CONTROL PLANT

*The transport facilities indicated in red are tentative concepts. Route alignment designations have yet to be determined.

Plate 1

CITY WIDE

NUMBER OVERFLOWS	SAVINGS ($x10^6$) BASED ON NPDES		MASS EMISSIONS: PERCENT REDUCTION FROM EXISTING		
	CAPITAL	ANNUAL	S.S	BOD_5	ANNUAL HOURS OF OVERFLOW
NPDES (c)			96	97	98 (b)
4	80	9 (a)	93 (b)	95	95
8	261 (a)	23 (a)	81	84	88
16	361 (a)	30	64	69	79



NUMBER OF OVERFLOWS	WET WEATHER CITY-WIDE COST ($x10^6$)	
	CAPITAL (1)	ANNUAL (2) (3)
1	1232 (a)	96 (a)
PRESENT NPDES (c)	1129 (b)	91
4	1049 (a)	82 (a)
8	868 (a)	68 (a)
16	768 (a)	61

a) updated costs to 12/78
b) typo correction
c) Does not reflect change in NPDES #CA 003 8407

(1) Includes cost of projects under construction. Construction costs based on (ENR 3200) Dec.'77. Sludge and reclamation costs not included. Sales and purchase of treatment plant land included.
(2) Annual cost is equal to equivalent capital cost plus O&M. Equivalent capital cost based bond payoff of 20 years at 6 5/8% interest, adjusted to(ENR3200) Dec.'77.
(3) O&M based on 20-year period, 8%/yr. inflation and 6 5/8%/yr. interest, adjusted to (ENR 3200).

CITY - WIDE

TABULATION OF BASE DATA

OVERFLOWS	COST ($ MILLION)		COST SAVING ($ MILLION) BASED ON NPDES		PERCENT REDUCTIONS BASED ON EXISTING							
	CAPITAL	ANNUAL	CAPITAL	ANNUAL	SUSP.SOLIDS		BOD_5		HOURS OVERFLOW		VIOLATION DAYS[2]	
					$lbx10^6$	%RED.	$lbx10^6$	%RED.	HOURS	% RED.	Days	% RED.
EXIST(82)	93[1]	7[1]	---	---	8.35	BASE	3.47	BASE	268	BASE	197	BASE
16	768	61	361	30	3.04	64	1.08	69	56	79	94	52
8	868	68[3]	261	23[3]	1.61	81	0.54	84	31	88	69	65
4	1049	82[3]	80	9[3]	0.57	93	0.18	95	14	95	37	81
NPDES (a)	1129	91	BASE	BASE	0.36	96	0.11	97	5.5	98	N/A	N/A
1	1232[3]	96.2[3]			0.17	98	0.06	98.5	3.5	99	10	95

(1) Includes costs of the wet-weather transport-storage facilities under construction as of October 1978

(2) Days of coliform levels greater 1000 MPN/100ml

(3) Numbers reflecting updated costs as of 12/78

(a) Does not reflect Regional Board decision of 11-21-78 changing overflow level in North Shore Zone to four (4).

PLATE 3

WESTSIDE ZONE

WASTEWATER GENERATED AND PERCENTAGE TREATED

	Generated (Mill. Gal./Yr)	Percentage Treated				
		Existing	16 O'flows	8 O'flows	4 O'flows	1 O'flows
Sanitary	8040	95.8	99.02	99.63	99.82	99.96
Urban Runoff	3030	16.9	66.3	86.1	93.4	98.4
Total Wastewater	11070	74.1	90.1	95.9	98.1	99.53

PLATE 4

WESTSIDE

TABULATION OF OVERFLOWS VS COST VS ACCOMPLISHMENTS

No. of Overflows	COST ($ MILLION)		Susp. Solids & BOD % Reduction from Existing	Coliform				Overflow	
				> 10,000		> 1000			
	Capital	Annual		Days	% Reduction	Days	% Reduction	Hrs.	% Reduction
Existing	-	-	-	70		119		372	
16	$167	$12	62	23	67	49	59	85	77
8	189	14	84	10	86	25	79	32	91
4	242	19	93	6	91	13	89	15.4	96
1(NPDES)	299	24	98	1	99	4	97	3.5	99+

PLATE 5

DISTRIBUTION OF ESTIMATED DAILY BEACH USERS

BEACH ACTIVITY SURVEY

Estimates of Daily Winter Time Usage (1)

ACTIVITY	Baker Beach	Phelan Beach	Lands End	North of Fulton	Fulton to Lawton	Lawton to Santiago	Santiago to Sloat	Ft. Funston	Thornton Beach	Totals (2)
Swimming	5	10	nil	5	5	5	5	5	5	25 - 50
Surfing	5	5	nil	30	10	15	25	5	nil	90
Fishing	20	5	10	nil	nil	6	5	5-10	5	60
Shell fishing	?	5	?	nil	nil	nil	nil	nil	nil	? (4)
Wading below waist	15	5	neg.	30	25	20	15	5	5	120
Wading above waist	5	5	neg.	5	5	5	5	5	5	25
Non-contact usage	250	60	50 (3)	600	430	220	260	300	35	2,165

(1) Based on Wastewater Program, December 1978 surveys

(2) Less than 5 counted as 2½ for total

(3) Considers only people on the several small pocket beaches in this area

(4) See text

PLATE 6

WESTSIDE COST-BENEFIT ANALYSIS

BASED ON RECREATIONAL BENEFICIARIES

Design No. of O'flows/yr	Days of coliform MPN >1000	Days		Annual Cost $x10^6$	Cost Diff. $ x 10^6	Per Diem Costs x $1000		Cost($) per beneficiary	Incremental Costs($) Per Addtl. Beneficiary
		from exist	between levels			from exist	between levels		
EXISTING	119								
			70		12		171		68
16	49	70		12		171		68	
			26		2		77		31
8	25	94		14		149		60	
			12		5		417		167
4	13	106		19		179		72	
			9		5		555		222
1	4	115		24		200		80	

NOTES: A beneficiary is a beach user (includes swimmers and surfers) that enjoys cleaner water (i.e. coliform MPN 1000) as a result of the elimination of overflows.

2500 people per day assumed visiting beaches after overflows in the Westside zone between the Golden Gate Bridge and Thornton Beach (from Table V-1)

PLATE 7

WESTSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

CONTROL LEVELS

Yearly O'flow Totals	Unit	Existing			16 per year		
		Min	Ave	Max	Min	Ave	Max
No. of Overflows	Event	26	114	193	6	16	31
% Reduction			Base			86	
Hours of Overflow	Hour	163	372	617	16	85	148
% Reduction			Base			77	
Total Wastewater	$Gal.x10^6$	926	2,870	5,030	151	1,100	2,360
% Reduction			Base			62	
Sanitary Discharge	$Gal.x10^6$	149	341	566	15	78	136
% Reduction			Base			77	
Urban Runoff	$Gal.x10^6$	774	2,520	4,450	136	1,020	2,220
% Reduction			Base			60	
Composition of Discharge (% Sanitary)	%		12			7.0	
Days Receiving Waster (near outfalls) coliform Levels exceed;							
(1) 10,000 MPN/100ml	Days	41	70	103	10	23	46
% Reduction			Base			67	
(2) 1,000 MPN/100ml	Days	67	119	147	23	49	90
% Reduction			Base			59	
BOD_5	$lbs.x10^3$	394	1,220	2,140	64	468	1,000
% Reduction			Base			62	
Suspended Solids	$lbs.x10^3$	3890	12,100	21,200	635	4630	9,930
% Reduction			Base			62	

PLATE 8

WESTSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

(continued)

CONTROL LEVELS

Yearly O'flow Totals	Unit	8 per year			4 per year			1 per year		
		Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
No. of Overflows	Event	1	8	18	0	4	11	0	1	4
% Reduction			93			96.5			99	
Hours of Overflow	Hours	2	32	78	0	15.4	42	0	3.5	18
% Reduction			91			96			99+	
Total Wastewater	Gal.x10^6	15	449	1070	0	213	563	0	52	265
% Reduction			84			92.5			98	
Sanitary Discharge	Gal.x10^6	1.8	29	72	0	14	39	0	3.2	17
% Reduction			91.5			95.7			99+	
Urban Runoff	Gal.x10^6	13	420	998	0	198	524	0	49	248
% Reduction			83			92			98	
Composition of Discharge (% Sanitary)	%		6.5			6.5			6.2	
Days Receiving Waster (near outfalls) coliform Levels exceed;										
(1) 10,000 MPN/100ml	Days	2	10	23	0	6	16	0	1	6
% Reduction			86			91.4			98.6	
(2) 1,000 MPN/100ml	Days	6	25	51	0	13	31	0	4	14
% Reduction			79			89			96.6	
BOD_5	lbs.x10^3	6.4	191	460	0	91	239	0	22	113
% Reduction			84			92.5			98	
Suspended Solids	lbs.x10^3	63.1	1890	4550	0	896	2360	0	219	1,110
% Reduction			84			925			98	

PLATE 8 - Continued

ABSTRACT REPORT

REVISED CITY WIDE OVERFLOW CONTROL STUDY - ABSTRACT REPORT WESTSIDE FACILITIES

SECTION 1

PURPOSE AND ORGANIZATION OF STUDY

The purposes of this study are to: (1) Respond to the Basin Plan recommendations and NPDES requirements for a revised benefit-cost analysis, including the investigation of measures such as outfall extensions, screening and disinfection to reduce the adverse impacts of overflows; (2) Respond to citizens' concerns about the high cost of the wet-weather overflow control facilities relative to the benefits derived; (3) Respond to EPA funding guidelines requiring cost-effective evaluations of combined sewer overflow projects.

This City-wide overflow study has been divided into three reports due to the need to reach an early agreement on the overflow frequencies for Westside and Northshore projects in order to avoid excessive delays in the scheduled advertising dates, and the need for additional field studies to address the potential for localized problems in pH, & dissolved oxygen levels in three confined bodies of water south of the Bay Bridge.

Each report will be published in two versions. A short abstract written in lay language, and covering only the salient issues is being prepared for use by the decision-makers on the Regional Board and the City's Board of Supervisors. A full report containing all the supporting technical studies will be prepared

and submitted to the technical staffs of the SWRCB, RWQCB, and EPA.

A draft of portions of the full report for the Northshore & Westside areas was submitted to the RWQCB staff in October 1978. Additional technical material will be submitted as it is developed. The tentative schedule for completing the remaining reports is as follows:

Abstract Report Northshore Outfalls - Completed Nov. 21, 1978

Abstract Report Westside - December 15, 1978

Full Report Northshore and Westside (combined) - January, 1979

Abstract & Full Report - May, 1979
Southeast Sector

Basin Plan Recommendations & NPDES Requirements For This Study

The 1975 Basin Plan discusses the "...difficult problem of wet weather control" presented by the combined sewer system in San Francisco and acknowledges the fact that any solution would be "inherently costly" and concludes with the recommendation "that a revised benefit-cost analysis be performed by the City for each zone, especially those areas which incur high recreation usage".

In March of 1976 the RWQCB issued NPDES Permits CA 0038415 and CA 0038407 for the wet-weather diversion structures in the Richmond-Sunset (Westside) and North Point sewerage zones.

Both permits contain identical language requiring the City to undertake the revised-benefit-cost analysis recommended in the Basin Plan and both permits contain the rather disturbing clause

"that the Regional Board will consider amendment of this Order to further reduce frequency of discharge after review of the information requested in Provision B-4 above" (Reference to B-4 above is to the revised benefit-cost analysis). However, at a meeting early this year RWQCB staff indicated to the City officials that they would be amenable to recommending a relaxation of the permitted overflow frequencies if the City's benefit-cost analysis so justifies.

Both permits mandate the Basin Plan recommendations against discharges into dead-end sloughs or discharges with less than 10:1 initial dilution, and both permits contain a clause to the effect that they will consider exceptions to these requirements.

Public Concerns

There is considerable public concern about the tremendous costs of the facilities needed to achieve compliance with the present discharge requirements. The City's 12½% share of the construction costs and the entirety of the operation and maintenance costs will be financed by the sewer service charge. This charge now averages $6 for a typical single-family residence per month and is expected to increase to $15 per month (assuming continuance of the same cost-proration formulae). Costs for the wet-weather facilities will amount to 60% to 70%, (depending on overflow frequency) of the total equivalent annual costs of the Master Plan facilities.

EPA Funding Guidelines for Combined Sewer Overflow (CSO) Projects

The Environmental Protection Agency (EPA) guidelines for funding

projects to control combined sewer overflows are contained in their Program Guidance Memorandum-61. This Memorandum requires that planning for CSO projects consider "The benefits to the receiving waters of a range of levels of pollution control during wet-weather conditions" and further requires as a condition for project approval that the final alternative selected satisfy the criterion that "The marginal costs are not substantial compared to the marginal benefits."

II - BACKGROUND

Existing Conditions

Because of limited treatment capacity and a lack of storage inherent in the existing system, overflows occur whenever rainfall exceeds 0.02" per hour, (a heavy drizzle). On the average these overflows occur 82 times a year. The excess flow is discharged through 39 shoreline overflow structures distributed around the priphery of the City. The composition of these overflows can range from approximately equal parts sanitary flow and runoff to greater than 50 parts runoff to one part sanitary and duration of the overflows can range from a few minutes to a few days. California Administrative Code standards for receiving water bacteriological quality are exceeded approximately 170 days a year (citywide average), due to sewer overflows.

Under the existing condition of 82 overflows per year approximately 97.5% of the City's sanitary flow and roughly 30% of the urban runoff receives treatment and primary disinfection.

Master Plan Recommendations

Studies for the control for wet-weather overflows were initiated in 1967. In 1971 the City published the comprehensive Master Plan containing recommendations for the construction of a series of upstream retention basins, transport-storage tunnels and a single wet-weather treatment plant, all for the purpose of limiting wet-weather overflows to a frequency of eight per year. Subsequent

revision to the Master Plan deleted a majority of the upstream retention basins in favor of shoreline outfall consolidation structures.

Basin Plan Recommendation For Overflow Frequency

The authors of the Basin Plan recommended that wet-weather overflow limitations be based on beneficial uses of the affected shoreline and specifically recommended overflow frequencies of 0.2 overflows per year to eight overflows per year. The Basin Plan authors also recommended the wet-weather overflows receive coarse screening to remove large visible floatable material, be discharged through outfalls designed to achieve a 10:1 initial dilution, be removed from dead-end slough and channels, and be discharged away from beaches and marinas. However, earlier in their discussion of wet-weather overflow problems, the authors stated that "The approach presented is conceptual and should not be interpreted as rigid numerical objectives. The specified control levels are based on available information and should be evaluated by the Regional Board and other agencies prior to the designation of such levels for each area." (emphasis ours)

Present NPDES Overflow Frequency Requirements

In 1976 the RWQCB issued NPDES permits for the wet-weather diversion structures. Permit CA 0038415 mandates the more stringent of the two Basin Plan recommended frequencies for the Westside portion, namely one overflow per year.

NPDES Permit CA 0038407 incorporated in RWQCB Order 76-24 for the North Point Sewerage Zone mandated one overflow per year for outfalls 9 through 17 and 4 overflows per year for outfalls 18 through 28.

RWQCB Order 78-102 dated November 21, 1978 amended order 76-24 to change the overflow frequency for outfalls 9-17 from one to four per year.

The Permit for the Southeast Zone, CA 0038423, established an overflow frequency of 4 per year for certain of the structures discharging into Islais Creek. No overflow frequencies are set for the balance of this zone apparently due to the uncertainties as to the nature and extent of the shellfish beds located in this zone.

SECTION III

City-wide Considerations

The planning for control of combined sewer overflows is a two-tiered effort. A City-wide evaluation is required, and is in progress, to determine the most cost-effective overflow flow management options (e.g single wet-weather plant versus several wet-weather plants) to achieve a particular level of wet-weather control and to evaluate the potential for any region-wide or long-term adverse effect of the total wet-weather overflow discharges. Once the City-wide level of effort and wet-weather flow management scheme is established, a zone-by-zone cost-benefit analysis can be made to maximize the benefits that would be derived from the overall expenditure levels. As part of the planning for the Southwest Treatment Plant, tasks were included to perform the City-wide element of the required revised cost-benefit analysis. The analysis confirms the cost-effectiveness of the original Master Plan concept of a single wet-weather plant in the Southwest portion of the City and the bulk of the Master Plan flow routing concepts. Cost and mass emission data developed during this analysis will serve as the basis for the following discussion of the City-wide cost-benefit considerations. However the discussions and conclusions are the City's.

City-wide Cost-Benefit Considerations

City-wide wet-weather costs have been compared with the expected benefits, i.e. reduction in pollutants discharged for City-wide overflow control frequencies of 16, 8, 4 and 1 overflows per year and the existing NPDES permit specified frequencies .An overflow frequency of four per year was assumed for those overflow diversion structures in the southeast zone that do not have NPDES permit frequencies specified. These comparisons are tabulated in Tables III-1 and III-2 and displayed graphically on Figure III-1.

Traditionally, cost-benefit analysis has consisted of plotting a cost-benefit curve with the expectation that a pronounced "knee of curve" will develop to suggest that optimal level of effort. This "text book" approach is difficult to apply to the City-wide overflow level for two reasons: 1) in this case, as in most real-world cases, no pronounced "knee of curve" appears. Rather, as indicated, the subject curves have a gradual curvature through the range of frequencies under consideration 2) In the cost-benefit analysis, the benefits are being measured indirectly. In effect, decreased emissions are being measured, not increases in the beneficial uses and productivity of the receiving waters.

Nevertheless, the curves do confirm the classic "law of diminishing returns" concept, that is, more stringent levels

of overflow control require a greater number of dollars be expended to remove incrementally less pollutants.

City-wide Impacts of Overflows

The estimated yearly citywide discharge of various pollutants to San Francisco Bay from combined sewer overflows has been compared to total yearly loadings of these pollutants into the Bay from tributary areas and the results tabulated in Table III-3. With the possible exception of coliforms, San Francisco wet-weather overflows contribute less than 1% of the total pollutant loads to the Bay for any of the pollutants evaluated. Comparisons of pollutant loadings for individual heavy metals and chlorinated hydrocarbons (herbicides, pesticides, etc.) have not been attempted due to the lack of both City data and total region-wide data for these pollutants.

We have no reason to believe that concentrations of any of these other pollutants would be unusually high in combined sewer overflows and would constitute more than a small percent of the total discharge to the Bay of these pollutants. It is concluded that even complete elimination of San Francisco wet-weather discharges would not result in any measurable permanent reduction, in the background Bay concentrations of any of these pollutants.

Because of the highly confined nature of certain waters in the Southeast portion of the City (i.e. Channel, Islais Creek, and Yosemite Channel/South Basin) there exists the possibility that wet-weather overflows could result in some very localized adverse impacts on the marine environment. Field studies will be undertaken

this winter to determine the magnitude and durations of these localized impacts.

CITY - WIDE

TABULATION OF BASE DATA

OVERFLOWS	COST ($ MILLION)		COST SAVING ($ MILLION) BASED ON NPDES		PERCENT REDUCTIONS BASED ON EXISTING							
	CAPITAL	ANNUAL	CAPITAL	ANNUAL	SUSP.SOLIDS		BOD_5		HOURS OVERFLOW		VIOLATION DAYS[2]	
					$lbx10^6$	%RED.	$lbx10^6$	%RED.	HOURS	% RED.	Days	% RED.
EXIST(82)	93[1]	7[1]	---	---	8.35	BASE	3.47	BASE	268	BASE	197	BASE
16	768	61	361	30	3.04	64	1.08	69	56	79	94	52
8	868	68[3]	261	23[3]	1.61	81	0.54	84	31	88	69	65
4	1049	82[3]	80	9[3]	0.57	93	0.18	95	14	95	37	81
NPDES (a)	1129	91	BASE	BASE	0.36	96	0.11	97	5.5	98	N/A	N/A
1	1232[3]	96.2[3]			0.17	98	0.06	98.5	3.5	99	10	95

(1) Includes costs of the wet-weather transport-storage facilities under construction as of October 1978

(2) Days of coliform levels greater 1000 MPN/100ml

(3) Numbers reflecting updated costs as of 12/78

(a) Does not reflect Regional Board decision of 11-21-78 changing overflow level in North Shore Zone to four (4).

Table III-1

CITY-WIDE COST-BENEFIT ANALYSIS

BASED ON RESREATIONAL BENEFICIARIES

Design Number of Overflows	Days of coliform MPN 1000/100ml	Days from between exist levels	Annual Costs $x106	Cost Diff. Diff. $x106	Per Diem cost $x106 from between exist. levels	Cost($) per beneficiary*	Costs ($) costs per addtl. beneficiary*
EXISTING[1]	171		---		0	0	
		117		61	0.52		173
16	54	117	61		0.52	173	
		24		7	0.29		97
8	30	141	68[2]		0.48	160	
		15		14	0.93		310
4	15	156	82[2]		0.53	177	
		11		14	1.27		423
1	4	167	96[2]		0.57	190	

(* A "beneficiary" is a beach user, including swimmers and surfers, that enjoys cleaner water, i.e. coliform MPN 1000, as a result of the elimination of overflows.

Costs are based on Metcalf & Eddy data.

3000[3] per day, assumed visitors to beaches after overflows City-wide plus San Mateo Coast, projected from CLER data, ocean waiver data, and Thornton Beach State Park data.

(1) For purposes of this plate, "Existing" denotes condition before any wet weather control projects constructed.
(2) Reflects updated costs as of 12/78
(3) Updated per beach surveys.

TABLE III-2

COMPARISON OF COMBINED SEWER OVERFLOW LOADINGS WITH [a] TOTAL BAY LOADING (POINT & NONPOINT)

10^6 lbs./year

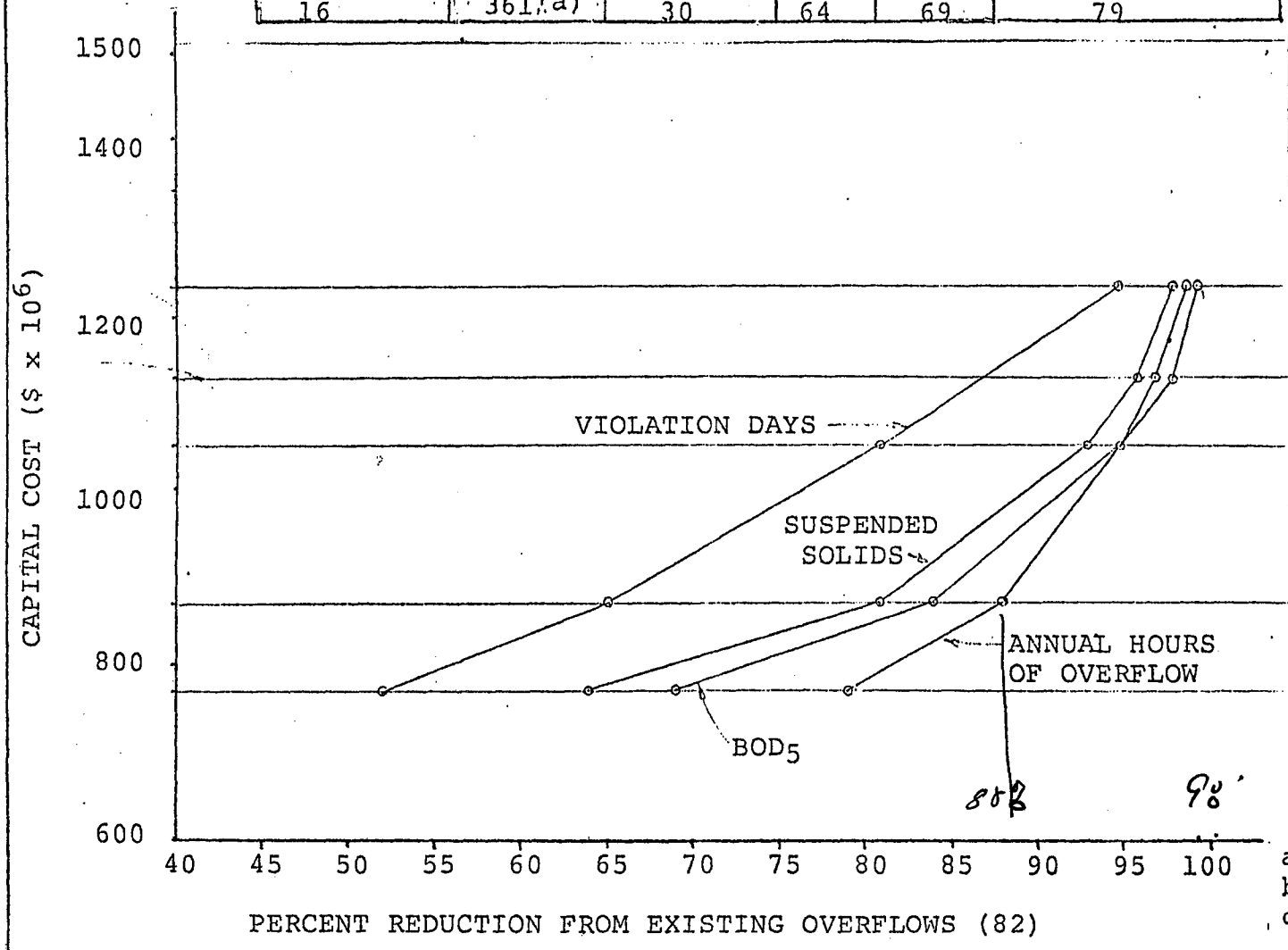
DESCRIPTION	SS	BOD	N	P	THM[f]
DELTA OVERFLOW	5100[b]	40	25	Unk.	5
BAY BASIN [c]	150	13	27	Unk.	5
SAN FRANCISCO TREATED [d] EFFLUENT	4	3	5	2	0.1
SAN FRANCISCO COMBINED [e] SEWER OVERFLOWS	13	0.7	0.14	Neg.	0.07
TOTAL	5213	60	60	Unk.	10
COMBINED SEWER OVERFLOWS % OF TOTAL LOADING	0.3	0.7	0.2	Neg.	0.7

a. Assuming secondary treatment of Bay Basin & San Francisco values the reduction percentages are as follows: suspended solids 90%, BOD 90%, N 90%, P 25%.
b. Average of values from Basin Plan, ABAG and Ocean Waiver application (after krome)
c. Treated effluent & Urban Runoff values from ABAG and Basin Plan.(does not include San Francisco discharges)
d. does not include values from Richmond-Sunset WPCP
e. Bayside Loadings only existing conditions
f. THM = Total Heavy Metals

TABLE III-3

CITY WIDE

NUMBER OVERFLOWS	SAVINGS ($x10^6$) BASED ON NPDES		MASS EMISSIONS: PERCENT REDUCTION FROM EXISTING		
	CAPITAL	ANNUAL	S.S	BOD_5	ANNUAL HOURS OF OVERFLOW
NPDES (c)			96	97	98 (b)
4	80	9 (a)	93 (b)	95	95
8	261 (a)	23 (a)	81	84	88
16	361 (a)	30	64	69	79



NUMBER OF OVERFLOWS	WET WEATHER CITY-WIDE COST ($x10^6$)	
	CAPITAL (1)	ANNUAL (2) (3)
1	1232 (a)	96 (a)
PRESENT NPDES (c)	1129 (b)	91
4	1049 (a)	82 (a)
8	868 (a)	68 (a)
16	768 (a)	61

a) updated costs to 12/78
b) typo correction
c) Does not reflect change in NPDES #CA 003 8407

(1) Includes cost of projects under construction. Construction costs based on (ENR 3200) Dec.'77. Sludge and reclamation costs not included. Sales and purchase of treatment plant land included.

(2) Annual cost is equal to equivalent capital cost plus O&M. Equivalent capital cost based bond payoff of 20 years at 6 5/8% interest, adjusted to(ENR3200) Dec.'77.

(3) O&M based on 20-year period, 8%/yr. inflation and 6 5/8%/yr. interest, adjusted to (ENR 3200).

Fig. III-1

SECTION IV WESTSIDE (OCEANSIDE)
WET WEATHER FACILITIES

Background

Previously impounded Federal funds were released in early 1975 and almost simultaneously an accelerated program for pollution control facilities was announced by the Governor and the State Water Resources Control Board for the dual purpose of reducing pollution and providing construction employment during a period of high unemployment in this industry. The City immediately organized a crash program to contract pollution control facilities which included Westside Transport Project.

The Regional Water Quality Control Board issued Order No. 74-164 to cease discharging treated primary effluent from the Richmond-Sunset Water Pollution Control Plant through the Mile Rock Outfall and Order No. 74-162 requiring the City to implement Stage I of the Master Plan to "most expeditiously and economically give impetus to the State Board's direction to implement a solution to the wet-weather problem in the West side of the City."

The City's Analysis of Alternatives report of December 1975,

recommended four (4) overflows per year for the Westside Transport, which included the Richmond and Sunset areas of the Westside District. The recommended project alignment was a tunnel and cut-and-cover tunnel in 42nd Avenue through a residential neighborhood. This alignment was adamantly rejected by the public.

Following a request from the State Water Resources Control Board the City prepared the Control Level Eligibility Report (June 1976) which established the cost-effectiveness of locating the consolidation sewer under the Upper Great Highway and reducing overflows to one (1) overflow per year ("C" level). This alignment is predominantly in public property, has adequate space for open-cut construction thereby allowing for economical construction benefits. The State concurred with this assessment and agreed to fund the redesign of the surface and roadway elements into an improved parkway as a mitigating measure.

However, the Central Coastal Commission (Regional) rejected the City's application for the required Coastal Commission Permit at their September 7, 1978 meeting due to concerns which we feel are exaggerated, regarding future beach erosion, sewer exposure, seismic and groundwater problems.

Following the City's request, the State Coastal Commission assumed jurisdiction from the Regional Commission and, pending a January 1979 overflow decision, is expected to act on the construction permit sometime in early 1979.

In the event that the Coastal Commission rejects the City's application, then a new alignment or storage concept will require evaluation. This would entail a complete redesign, probably greater costs, would require a new EIR and delay implementation of the project by at least one year.

A Lower Great Highway alignment or a more inland alignment would present major problems in developing sufficient storage volumes for the one overflow per year control level, and still be subject to considerable community opposition. Because of our belief that the cost consequences of the overflow frequency decision on a more inland route would be as large if not larger than the cost consequences for the Upper Great Highway, and the major uncertainties about the location of any acceptable alternative to the Upper Great Highway route the project description and cost-benefit analysis in this report will be restricted to the Upper Great Highway alternative.

PROJECT

The concept which underlies all overflow alternatives in the Great Highway is an "intercepting system" whereby the sewer functions as a storage facility and as a transport conduit. By maximizing the continuous movement of sewage in a storage facility, excessive deposition of solids is prevented. The major storage facility (Westside Transport) is located under the Upper Great Highway between Fulton Street and the Westside Pump Station just south of Sloat Boulevard. The Richmond and Lake Merced area flows will be collected and directed to storage in the Westside Transport via tunnels. Tunnel economics dictate the smallest tunnel to be approximately 9' in diameter. Therefore, those elements are approximately the same for most overflow frequencies.

An increase in the number of permitted overflows would result in a reduction in the size of the consolidation sewer and $\frac{a}{x}\frac{m}{y}$ result in a reduction in the size of the required Westside Pump Station and Southwest Water Pollution Control Plant. Metcalf & Eddy, as part of the SWWPCP facilities plan, has further evaluated storage/treatment overflow combination encompassing the entire Oceanside district. The values in table IV-1 are adaptations of their City-wide cost evaluation. Because these combinations are of a palnning level, of accuracy, further refinements are expected.

Storm flows would be by gravity to the Westside Transport for storage and transport to the Westside Pump Station, then pumped to the proposed Southwest Water Pollution Control Plant (SWWPCP) south of the Zoo for treatment. Effluent would be discharged into the ocean two miles offshore via a deep-water outfall. When storage and withdrawal rates are exceeded, bypassing would occur with some control through the Vicente and Lincoln Way Outfalls, Lake Merced and Baker's Beach (Richmond) Outfalls with possible selectivity into the Mile Rock Outfall.

Upon completion, the SWWPCP control plant will be the city-wide wet-weather treatment facility and the dry-weather treatment facility for the Westside District. The existing Richmond-Sunset Water Pollution Control Plant located in Golden Gate Park will be abandoned, thereby returning four acres of park land to recreational uses.

The Mile Rock Outfall (shoreline discharge) now functins as both the effluent outfall for the Richmond-Sunset plant and as a wet-weather overflow discharge for flows originating in the westerly portion of the Richmond-Sunset district. Upon relocation of the dry-weather treatment to the Southwest site, dry-weather discharges to Mile Rock would cease and wet-weather discharges would be reduced to the specified frequency. The elimination of the continuous dry-weather discharge of 20 MGD would in all probability be more significant than the reduction of wet-weather discharges in restoring

presently depressed shoreline marine biota to more normal levels.

The Westside Transport, as presently designed for one overflow per year, consists of a rectangular transport storage structure, with a single 25-foot-wide channel from Fulton to Lincoln Way and two(2) 25-foot channels from Lincoln Way to the Westside Pump Station. All overflow alternatives require a large bypass structure at Lincoln Way and a smaller bypass facility at Vicente to control the overflow operation through the existing outfalls.

For 4 overflows per year the consolidating sewer in the Great Highway is reduced to a single 25-foot channel with a 1,300 foot and 1,200 foot long bypass structures at Lincoln Way and Vicente Street, respectively. Richmond and Lake Merced facilities would remain the same. Though the SWWPCP wet weather treatment remains at 640 MGD, that portion attributable to the Oceanside area is reduced from 240 MGD to 160 MGD.

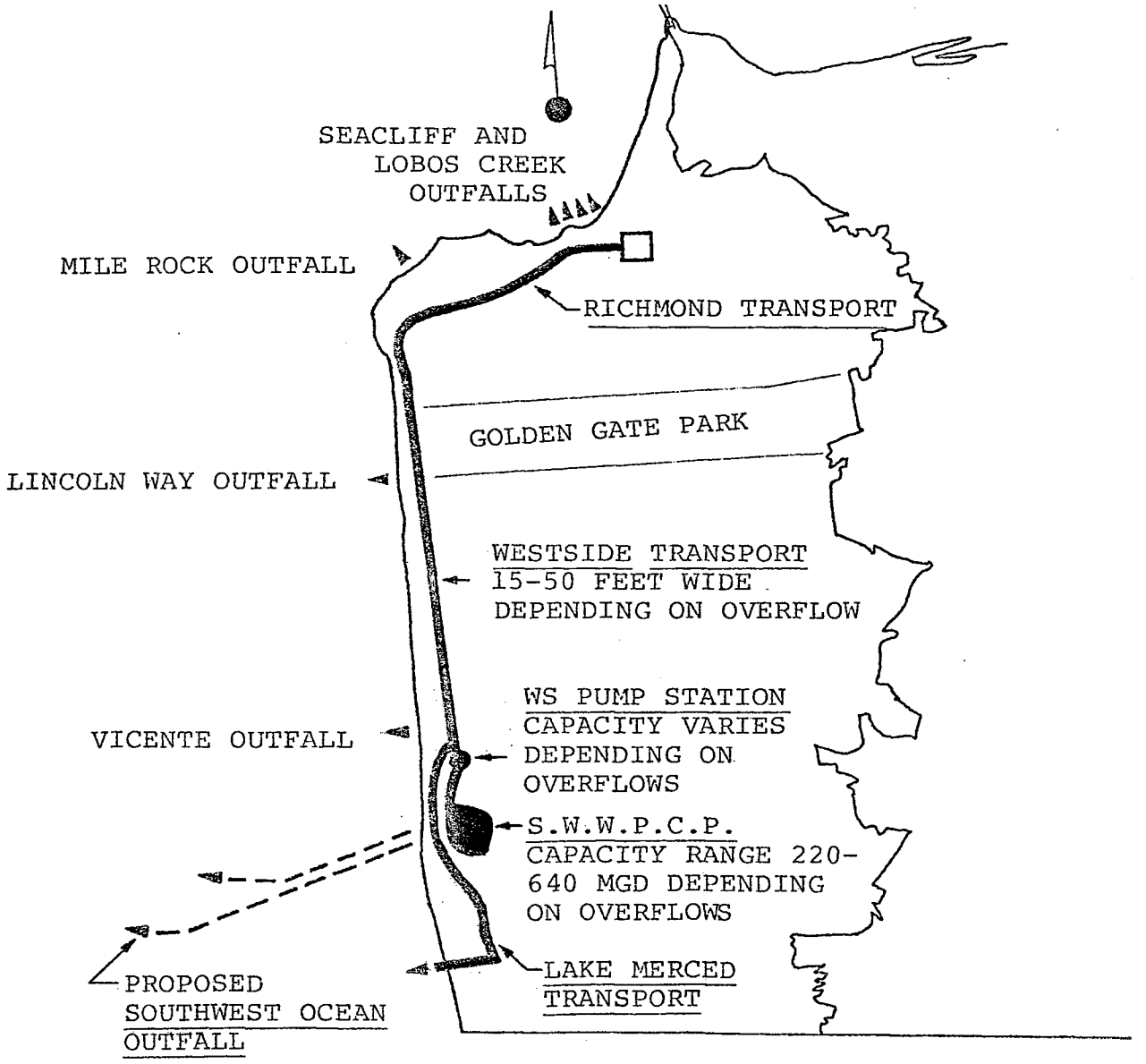
For 8 overflows/year the single channel reduces to a 17.5 foot width, the Lincoln Way structure remains at 1,300 feet but the Vicente structure is approximately 50 feet long. The SWWPCP wet weather plant is now reduced to 400 MGD, that portion attributable to the Oceanside area is reduced from 160 MGD to 80 MGD.

While this report contains cost estimates for the above frequencies and 16 overflows per year, general assumptions were made and results should be used for planning comparison only. As the overflows are increased, the existing sewere system storage capacity becomes a more significant part of the operation. A detailed analysis of that operation is beyond the time and scope of this report.

The present design of the Westside Pump Station as approved by the State for one overflow per year could be modified to provide the reduced dewatering requirements to approach four (4) overflows per year. The eight (8) overflow/year reduction would require a more significant modification of the station.

Assuming an overflow decision by January 15, 1979, the advertising date for a system for one or four overflows with the alignment in the Upper Great Highway could be approximately June 1979 which includes completion of the permit process and an EIR amendment. A system for eight (8) overflows per year may require a full EIR amendment extending the advertising date to November of 1979.

A schematic of the system and system cost breakdowns are shown on Figure IV-1 and Table IV-1, respectively.



W E S T S I D E F A C I L I T I E S

FIGURE IV - I

WESTSIDE COSTS FOR VARIOUS OVERFLOWS

COSTS ($x10^6$)

ELEMENTS	OVERFLOW FREQUENCY			
	1	4	8	16
LAKE MERCED TRANSPORT (1)				
SIZE (M. GAL.)	7.9	7.9	7.9	7.9
CAPITAL COSTS	$ 50.6	$ 50.6	$ 50.6	$ 50.6
AMORTIZATION	3.7	3.7	3.7	3.7
O & M	NIL	NIL	NIL	NIL
EQUIV. ANNUAL	3.7	3.7	3.7	3.7
RICHMOND TRANSPORT (1)				
SIZE (M. GAL.)	9.6	9.6	9.6	9.6
CAPITAL COSTS	39.3	39.3	39.3	39.3
AMORTIZATION	2.9	2.9	2.9	2.9
O & M	NIL	NIL	NIL	NIL
EQUIV. ANNUAL	2.9	2.9	2.9	2.9
WESTSIDE TRANSPORT				
SIZE (M. GAL.)	82.5	56.4	47.5 (2)	25.5
CAPITAL COSTS	92.2	70.5	60.0	37.0
AMORTIZATION	6.7	5.2	3.6	2.7
O & M	NIL	NIL	NIL	NIL
EQUIV. ANNUAL	6.7	5.2	3.6	2.7
TOTAL WS VOL. (M. GAL.)	100.0	74.0	65.0	43.0
SUB-TOTAL COSTS				
CAPITAL	$ 182	$ 161	$ 150	$ 127
AMORTIZATION	13	12	10	9
O & M	NIL	NIL	NIL	NIL
EQUIV. ANNUAL	13	12	10	9

(1) Includes 0.5×10^6 $Ft.^3$ upstream basins.

(2) Hydraulic Modelling is required to verify the 17.5 feet width.

TABLE IV-1

WESTSIDE COSTS FOR VARIOUS OVERFLOWS

(Continued)

Costs ($\#x10^6$)

ELEMENTS	OVERFLOW FREQUENCY			
	1	4	8	16
WESTSIDE P.S. (W.W.)				
SIZE (MGD WW)(5)	290	210	130	110
CAPITAL COST	$ 25.5	$ 21.5	$ 13.5	$ 11.3
AMORTIZATION	2.2	1.8	1.2	0.97
O & M	0.2	0.2	0.1	0.07
EQUIV. ANNUAL	2.4	2.0	1.3	1.04
SWWPCP (WW)				
SIZE (MGD)	240	160	80	60
CAPITAL COST(3)	91.6	61.4	30.7	23.0
AMORTIZATION	7.5	5.0	2.5	1.9
O & M(4)	0.6	0.4	0.2	0.2
EQUIV. ANNUAL	8.1	5.4	2.7	2.1
SWOOP (PRO-RATA)				
SIZE (MGD)	640	560	480	460
CAPITAL COSTS	Base	-2.3	-5.2	-5.9
AMORTIZATION	Base	-0.25	-0.39	-0.44
O & M	←	constant		→
EQUIVALENT ANNUAL	Base	-0.25	-0.39	-0.44
TOTALS				
CAPITAL COSTS	$299	$ 242	$ 189	$167
ANNUAL AMORTIZATION	23	18 20	14	12
O & M	0.8	0.6	0.3	0.1
EQUIVALENT ANNUAL	24	19	14	12

(3) 0.384×10^6/MGD

(4) Treatment O & M prorated from SWWPCP Facility Plan Values on the basis of westside flow to the total flow

(5) Pump station capacity will be increased by some amount for optimum system operation

TABLE IV-1(Continued)

SECTION V

IMPACTS OF OVERFLOWS ON BENEFICIAL USES

Areas Impacted by Wet Weather Overflows from the Westside (Oceanside Area)

A series of dye studies and float studies was run on the Corps of Engineers' hydraulic model of S. F. Bay, located in Sausalito (BayDelta Model) for the purpose of determining the area and temporal extent of the impacts from wet-weather overflows.

Data analysis of these tests is in progress. A preliminary analysis of the North Shore dye and float releases has been made. The analysis indicates that the shoreline areas most heavily impacted by overflows extend from the Golden Gate Bridge to Thornton Beach State Park. The discharge field from the Mile Rock Outfall will move inside of the Golden Gate Bridge on the flood tide. The only shoreline areas inside of the Golden Gate that may be contacted by the Mile Rock field are the Southeasterly tip of Angel Island and the northerly shore of Alcatraz Island. The possibility exists that under conditions of a strong northerly wind the field could come ashore along the northerly waterfront of the City. However, the Model test results suggest that the field would be highly diluted (1000:1) when and if it contacted a shoreline area within the Bay.

Results from the Corps' Model tests are questionable. It is believed that the Model gives reasonably accurate current patterns at the entrance to the Golden Gate and within the Bay. However, the the dispersion results and the currents along Ocean Beach have not been confirmed. We know of only one field study of shoreline releases on the Westside. This was a 1908 planning study for the Mile Rock Outfall and consisted of the tracking of floats released under varying tidal conditions at the Mile Rock site and at what was then called "X" Street (approximately Fleishacker Pool). As best as we can determine from the very sketchy published report of said study (1909 Report of the Board of Public Works) the results of the Model studies are in general agreement with the 1908 field study.

Beneficial Uses of the Ocean Shoreline -
Golden Gate Bridge to Mussel Rocks in San Mateo County

The entirety of this shoreline is under the jurisdiction of the California Coastal Commission. The Golden Gate National Recreation Area (GGNRA) has legal ownership and administrative responsibilities for the San Francisco portion of the shoreline. The California Department of Parks and Recreation has similar responsibilities for the Thornton Beach State Park portion of the affected San Francisco shoreline. There is legal public access to the entirety of this shoreline, though physical access to the water's edge is difficult in the

Land's End, and Golden Gate Bridge areas due to the steep terrain. The only beneficial uses are fish and wildlife habitat and non-water contact recreation. Industrial and maritime uses of the shoreline do not now exist nor are they likely to be created in the foreseeable future.

Effects on Marine Life

The evaluation of the effects of combined sewer overflows on the marine biota requires considerations of both the acute effects on the intertidal macro-fauna living in close proximity to the outfall and long-term effects on the total marine environment. Unfortunately almost nothing is known about either. A preliminary literature search and a field reconnaissance (Sutton, December 1978 draft) suggest that the sandy beach areas are relatively barren. Intertidal macro-fauna consists of primarily amphipods (sand fleas), isopods (a small sessile custacean), polychaete worms and mole craps. The limited number of shell fragments suggest the possibility that the straight horse mussel, gaper clam?, the rough piddock and the horseneck clam may also be present. Sand dollars are present in the offshore area. The relatively depauperate nature of the beaches may be due to natural conditions as relatively few species are adapted to open coast, sand, beach environments. The rocky areas (Lands End, Mussel Rocks, Fort Point) contain gooseneck barnacles, California mussels, limpets, litturine snails sea anemones, ochie sea stars algae and sea grasses. The attached fauna is noticeably depressed

in the vicinity of the Mile Rock outfall. This probably is most attributable to the year round discharge of primary effluent which is chlorinated but, until very recently, not dechlorinated rather than to the wet-weather overflows that also occur through this outfall.

Static 96 hours toxocity tests have been run on undiluted samples of wet-weather overflows using the three spine stickleback. 100% survival occurred in over half of the 61 samples tested.

Many marine biologists consider three spine stickleback tests as non-representive of waste discharge toxicity because the stickleback is a pollution tolerant species. It is also true that few, if any organisms in their natural setting would ever be exposed to any where near 96 hours of undiluted overflow.

The long-term benefits to the Marine environment that would result from the reduction, or ever complete eliminating in heavy metals, and trace organics discharged during overflows is impossible to quantify.

Heavy metals, and trace organics (herbicides pesticides etc.) are the most significant pollutants discharged of wet-weather overflows. Data on trace organics in wet-weather flows is non-existent. Data on metals is limited to lead, chrome, iron, copper & zinc (see table V-3). Lead, presumably from vehicle emission fallout, is the only metal that has a higher concentration

in wet-weather flows. Estimates of yearly mass emissions of lead for existing conditions and for overflows of 16, 8, 4, 1, & 0 per year are shown in Figure V-1. As indicated even complete elimination of westside wet-weather overflows would not completely eliminate discharges of lead.

Two important points in this regard are (1) that by having a combined system will be removing a notable significant percentage of contaminates, such as lead, that originate from urban runoff and (2) In terms of Total Heavy Metal discharged to the Bay, San Francisco's wet-weather overflows (existing conditions) constitute less than 1% of the total. In conclusion it is problematical whether even complete elimination of wet weather overflows would result in a measurable reduction in the concentrations of heavy metals found in either in the receiving water or sediments other than perhaps in the immediate proximity of the overflow discharge points.

SECTION VII

POSSIBLE MEASURES TO MITIGATE THE ADVERSE IMPACTS OF OVERFLOWS ON THE RECREATIONAL USE OF THE RECEIVING WATERS

Four possible measures to mitigate the adverse impacts of overflows on recreational use of the receiving waters are:

Baffling of Overflows to reduce floatables

Screening of overflows

Extended overflow outfalls

Disinfection of overflows

Our preliminary analysis of the costs, merits, and operational aspects of these measures is as follows:

Baffling and Screening of Floatables

Solid materials in combined sewer flows that could degrade the appearance of beaches if washed ashore include: rags, fecal material, toilet tissue, paper towels, tampon applicators, sanitary napkins, condoms, dead rats, candy and cigarette wrappers, and cigarette filter tips. In addition to these coarse solids, combined sewage flows can contain a considerable quantity of natural vegetable material, including leaves and twigs. Therefore, the feasibility of providing baffling and screening (bar racks, fixed and mechanically cleaned and Rotostrainers) was examined.

Existing Recreational Uses

Approximately 80% of the 11 miles of affected or possibly affected shoreline is sandy beach. The balance of the area has steep cliffs dropping directly to the sea (Land's End and the areas on either side of Baker's Beach). Water-contact recreation in the cliff areas is essentially confined to fishing and some shellfishing. Recreational usage of the principle beach areas follow. These areas are depicted on Figure V-2.

Baker's Beach

Use of this beach includes surf fishing (especially in the morning), sunbathing, jogging, picnicking, walking, and possibly some collection of mussels along the rocks to the northeast. Swimming is discouraged from this beach by the GGNRA, and is infrequent. A shark attack several years ago has also discouraged swimming. The beach and water are frequented by family groups; children find the surf an inviting playground. This beach receives use from nearby residents. During sunny days, visitor levels increase dramatically. The vehicle counts by the Park Service at the Baker's Beach road include people coming to use the forested picnic grounds and vollyball court uphill from the beach.

Phelan Beach

This small beach is used primarily for volleyball, swimming, sunbathing (mainly on the sundeck of the beach house), and picnicking. Swimming is encouraged here by the GGNRA because the waters are relatively sheltered from strong shoreline currents. However, counts by wastewater personnel and information received from a regular swimmer suggest that wintertime swimming is limited to about ten swimmers each day. The area is regularly used by local residents, who gather there almost every day. The beach is too short to be used by joggers. Fishing and mussel collecting occur in the rocky areas on either side of the beach. Sunny days bring more people to this beach, but because of its remote location within a residential area, and limited parking, use is restricted mostly to local residents.

Kelly's Cove

Kelly's Cove is the stretch of Ocean Beach from Cliff House to Lincoln Way. It is a favorite year-round surfing spot and jogging area. It is very accessible to sightseers because of parking availability along the Great Highway. Swimming is discouraged here by the GGNRA (Park Service) by signs warning of strong rip tides, undertows, and the potential risk of drowning. On sunny days, picnickers sit along the beach wall; wading occurs frequently under these ideal weather conditions, especially on weekends. Swimming may

occur frequently on hot summer days, but is relatively light (only a few people per day) throughout most of the year. Fishing is infrequent.

Ocean Beach - Lincoln Way to Vicente

Ocean Beach between Lincoln Way and Vicente Street is used primarily by local residents because it does not have nearby parking. Major access is through rather dark, uninviting pedestrian underpasses. Sunbathing, jogging, and walking are the primary activities along this stretch. Some fishing, wading, surfing, horseback riding and swimming occur. The four drownings in the last three years have occurred along this stretch of beach.

Ocean Beach - South of Vicente

Ocean Beach between Vicente Street and Mussel Rock contains Fort Funston (GGNRA) Beach and Thornton State Beach. However, it is composed of four very different sections of beach. These are: 1) The Overlook Parking area (heavily used for many activities), 2) the Fort Funston sea cliffs (remote from parking and lightly used), 3) Thornton State Beach (accessible and moderately heavy use), and 4) the remainder of the beach to Mussel Rock (remote from parking and lightly used).

The proximity of the Zoo and the two overlooking parking lots along the Great Highway make the stretch of beach between Sloat Boulevard and the Fort Funston sea cliffs easiliy accessible. It is heavily used on weekday afternoons and weekends. Surfing, swimming, picnicking, walking, jogging, and fishing are all popular activities here. Usually 20 to 30 children from the Recreation Center for the Handicapped come here for swimming, wading, and playing on the beach each week during the year.

The less accessible stretch of Fort Funston Beach beneath the seacliffs is used by walkers, joggers, horseback riders, sunbathers, and hang-gliding activity.

Thornton State Beach is used by picnickers, joggers, remote-control model airplane flyers, fishermen, and an occasional swimmer. Picnic benches and other facilities here are well above the beach, making it unlikely that all Park visitors actually go down to the beach.

Estimates of Beach Usage

Available data on average daily beach usage is very limited and consists of estimates based on car counts multiplied by an average vehicle occupancy factor (GGNRA and California Parks and Recreation data) self-monitoring program data and two one-time surveys of beach usage undertaken by the Wastewater

Program (CLER Report - 1975 and Ocean Waiver Application 1978). The car count data provides no indication of the people that actually go onto the beach (a small percent of the total in some areas) nor what recreational activities are pursued by these people. The 1975 CLER estimates were extrapolated from two one-day comprehensive counts made in the fall of that year and were limited in both coverage (Sloat Boulevard to Kelly's Cove) and recreational activities that were classified. The plant monitoring data consists of spot observations at selected points, usually about noon, but contains little weekend data and provides no indication of daily totals.

The Ocean Waiver data, while comprehensive in area coverage and types of activities tabulated, was based on summer spot counts (morning, noon, and afternoon) over two separate weeks, during the summer.

In addition to the above, the Wastewater Program had environmental consultants prepare an assessment of recreational beach use (Recreational Usage Along the San Francisco Waterfront, Part I, Bay Bridge to Mussel Rocks, November 1978). Because of public health considerations, emphasis was placed on swimmers and surfers. This report relied extensively on interviews with GGNRA personnel. Apparently, the information provided by GGNRA in some cases, reflected peak (warm weather weekend) rather than average daily swimmers. In addition, our consultant applied very conservative assumptions to the GGNRA information

in making their projections, with a result that the estimates of swimming activity outside of the Golden Gate appear to be quite high.

Because of the great disparity in ocean side estimates of swimmers, we undertook a combination of spot and continuous counts of ocean side recreational activities during the first two weekends in December. The results of these counts are shown on Table V-I.

Because of the atypical nice weather on the first weekend of the survey, the decision to place primary emphasis on surfing and swimming during the second weekend of the survey, and the fact that conservative assumptions (high) were used in resolving conflicts in counts and filling gaps in the data, the data and in particular the non-contact data, should be considered as soft. Ratios between weekend and weekday usage established during 1975 and the July 1978 survey wereused used to compute average daily estimates from the weekend data. As indicated by Table V-I the estimates for oceanside swimming (25-50) is greater than one order of magnitude lower than the estimate contained in the November report. However, the estimates for surfers are in general agreement. We and the project manager for our consultant believe that the November Report estimate of wintertime average daily swimmers is signigicantly in error for the oceanside. Several observations made of swimming in Aquatic Park confirm the

November report estimate for Aquatic Park which was based on information received from the Dolphin Club and South End Rowing Club Officials.

It must be noted that the proposed Great Highway redesign to a parkway will likely change and redistribute beach usage from that observed at this point.

The most serious public health problem posed by combined sewer overflows is probably viral contamination of shellfish (molluscs). This is unfortunately the most difficult activity to survey due to the multiplicity of access points to the mussel areas, the steep terrain in the area, and considerable day-to-day variation in this activity because shore access to some of the areas is contingent upon the tides. Clamming in the sandy beach areas is virtually non-existent as there is no known population of clams in this area. Harvesting of mussels does occur in the Phelan Beach - Land's End area as evidenced by the sighting of one family returning with approximately 5 gallons of mussels and by Department of Public Health data showing several reported cases of paralytic shellfish poisoning resulting from consumption of mussels harvested in this area. (Paralytic shellfish poisoning is caused by the naturally occurring marine bio-toxin contained in the dinoflaggelates responsible for the formation of red-tides). However, the fact that several of the most accessible mussel-supporting rocks have essentially intact populations of large mussels suggest that mussel harvesting is not extensively practiced.

Public Health Considerations

The protection of public health is frequently advanced as a justification for the expenditures of the large sums of money needed to control combined sewer overflows. Unfortunately the available epidemiological data does not support this justification. Information received by our Department of Public Health (Appendix A) shows no clinically confirmed cases of enteric diseases from either recreational contact with Bay or Ocean waters or the consumption of shellfish harvested from these waters in 25 years of records. Information received from the California Department of Health Services confirms this negative finding (Appendix C). Because the etiology of particular cases of disease is often difficult to establish, a comparison was made of the reported disease rates for wet, dry and normal rainfall years (Appendix B). No disease rate-rainfall correlations were evident.

The above findings are not surprising when one considers that transmission of disease through swimming in fecally contaminated natural bodies of water is not a major vehicle of enteric disease transmission. In fact, the only swimming related reported outbreak of disease in the United States during 1977 occurred in a swimming pool (Journal Water Pollution Control Federation June 1978). It should be pointed out that public health statistics do not reflect minor illnesses as most people do not seek medical assistance for such illnesses or if they do, the diagnosis is frequently not confirmed by clinical testing.

Since the public health statistics show negative (i.e. no reported cases), unreported cases are impossible to quantify for purposes of cause-effect evaluations. Predictable methods require a lot of assumptions and are at best rough approximations of baterial diseases and non-existent for enteroviral diseases (Professor Robert Cooper/ESA November 1978). Therefore indirect methods of evaluating the public health benefits, i.e. reduction in disease, must be sought.

One way to indirectly measure the benefits derived from reducing the occurrance of sewer overflows is to estimate the reduction on the number of days during which the receiving water coliform levels exceed regulatory agency standards (violation days). The problem with this approach is that there are three numerical coliform standards that apply to water used for body-contact recreation. These standards were developed for monitoring of dry weather discharges of more or less uniform quality and are supposed to be essentially equivalent. Application of the three standards to wet-weather overflows yield three appreciably different estimates of the number of violation days caused by a given overflow. Because of this and an interpretation problem with the 30-day, 20 percentile greater than 1000 standard, a clarification from the California Department of Health Services has been requested. Therefore, for the purposes of the cost-benefit analysis only, the following criterion is used: any day with an estimated coliform MPN of 1000/100 ml or less will be considered as acceptable and days with higher coliform values will be considered as unacceptable.

Aesthetics

The problem of aesthetic degradation of the beaches due to floatables of sewage origin (feces, toilet tissue, condoms, sanitary napkins, tampon applicators, etc.) is virtually impossible to quantify. The available information is very limited and in some respects, contradictory.

A 1967 study of particulate floatables in the waters immediately offshore of Baker Street found that 98% of these floatables following an overflow were of non-sewage origin (twigs, animal debris, etc.) As part of the City's self-monitoring program, plant personnel make subjective observations of the amount of sewage solids on the beach, and they have observed that the deposits are usually light. However, GGNRA personnel have noted heavy deposits of sewage solids on the beach after an overflow. Scattered observations made by various Wastewater Program personnel are inconsistent. Observations made at Lincoln Way, Bakers Beach & Phelan Beach after the first two overflows of this winter indicate that leaves, twigs and cigarette filter tips were the dominant material in the overflow debris line. Feces were present, typically in well rounded 3/4" diameter pieces with a density of 4-6 pieces per 100' of debris line, tampon applicators averaged 4 per 1000', no sanitary napkins were noted and only one condom and one dead rat (at Bakers Beach) was found. These observations may not be representative of average conditions as both overflows were relatively small and possibly contained a disproportionately high percentage leaves & twigs & other street and yard debris

that had accumulated through the rainless summer months.

Doubtless tidal currents and wind induced current dictate the amount of sewage solids that will be deposited on a given beach after a storm overflow. Another complicating factor is the heavy presence of dog feces which are present on many San Francisco beaches year round and are frequently indistinguishable from human feces. These factors and the highly subjective nature of any observer comments can explain the inconsistencies in the observations. The length of time that these solids will remain on the beach can vary from perhaps less than a day to two weeks, depending on tide, and wind conditions. These considerations make it presently impossible to develop an appropriate yardstick of visual pollution for use in a cost-benefit analysis.

BEACH ACTIVITY SURVEY

Estimates of Daily Winter Time Usage [1]

ACTIVITY	Baker Beach	Phelan Beach	Lands End	North of Fulton	Fulton to Lawton	Lawton to Santiago	Santiago to Sloat	Ft. Funston	Thornton Beach	Totals [2]
Swimming	5	10	nil	5	5	5	5	5	5	25 - 50
Surfing	5	5	nil	30	10	15	25	5	nil	90
Fishing	20	5	10	nil	nil	6	5	5-10	5	60
Shell fishing	?	5	?	nil	nil	nil	nil	nil	nil	? [4]
Wading below waist	15	5	neg.	30	25	20	15	5	5	120
Wading above waist	5	5	neg.	5	5	5	5	5	5	25
Non-contact usage	250	60	50 [3]	600	430	220	260	300	35	2,165

(1) Based on Wastewater Program, December 1978 surveys

(2) Less than 5 counted as 2½ for total

(3) Considers only people on the several small pocket beaches in this area

(4) See text

Table V-1

TABLE V-2

MONTHLY DISTRIBUTION OF AVERAGE ANNUAL
COMBINED SEWER OVERFLOW EVENTS ON WESTSIDE

Overflow	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Treatment Rate: 0.06 in./hr												
16: Number	3.56	2.79	1.88	0.75	0.37	0.12	0	0.02	0.13	0.82	1.96	3.24
% of Annual	22.8	17.9	12.0	4.80	2.35	0.75	0	0.09	0.85	5.27	12.5	20.7
8: Number	1.96	1.32	1.00	0.29	0.13	0.03	0	0	0.09	0.44	0.94	1.69
% of Annual	24.8	16.8	12.7	3.72	1.68	0.37	0	0	1.12	5.59	11.9	21.4
4: Number	1.12	0.62	0.44	0.15	0.04	0	0	0	0.06	0.18	0.51	0.81
% of Annual	28.5	15.7	11.2	3.75	1.12	0	0	0	1.50	4.49	13.1	20.6
1: Number	0.25	0.13	0.12	0.06	0	0	0	0	0.02	0.04	0.12	0.25
% of Annual	25.4	13.4	11.9	5.97	0	0	0	0	1.49	4.48	11.9	25.4

TABLE V-3

Representative Wet & Dry Weather Concentrations for selected Metals

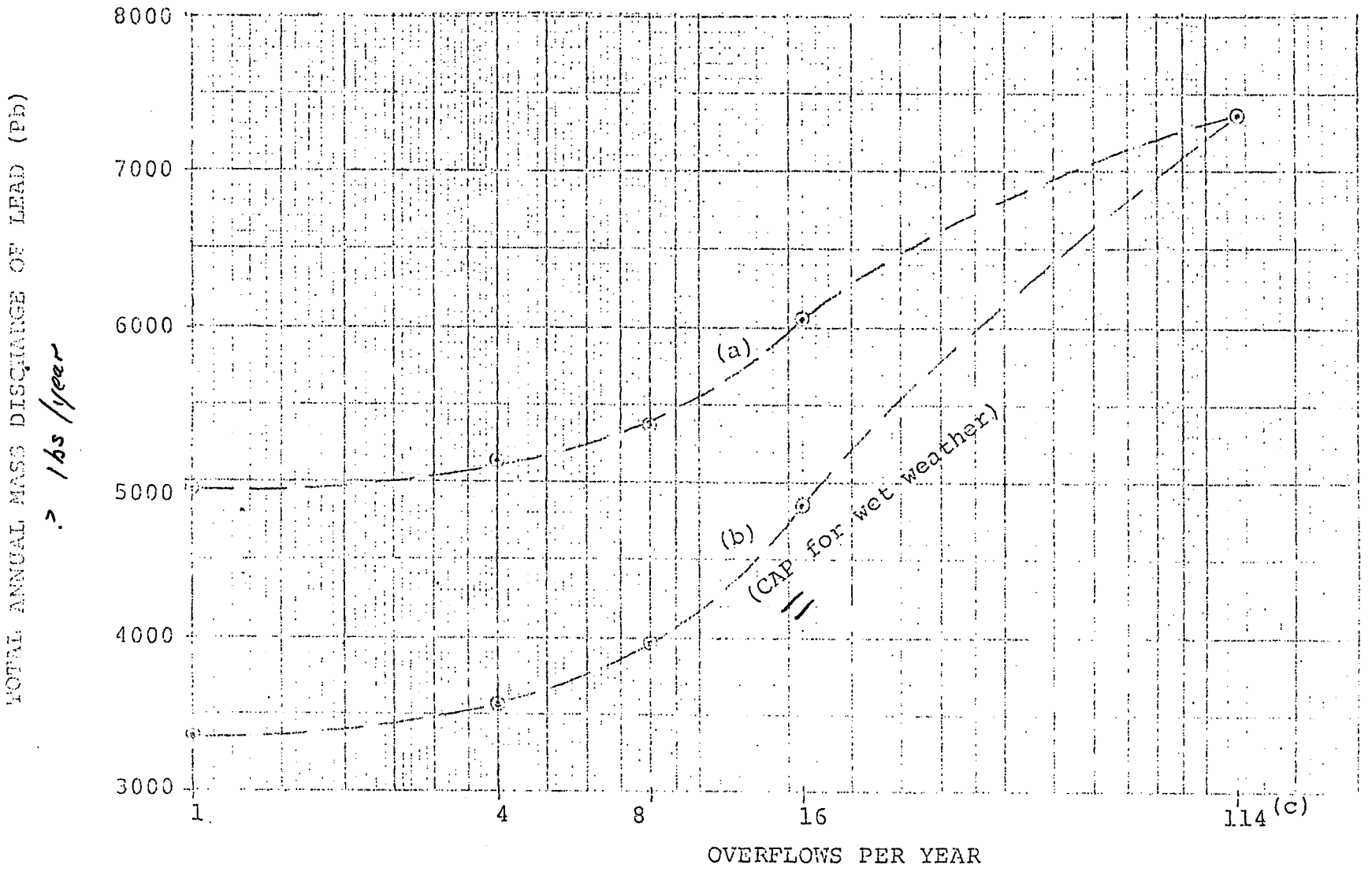
Units = Mg/kg

	Wet & Dry	
Lead	0.1 to 1.2	0.1
Chromium	> 0.4	0.03
Iron	> 0.4 to 11.0	I.D. *
Copper	> 0.4 to 0.6	0.7
Zinc	0.06 to 0.6	0.2
Silver	I.D. *	0.012
Arsenic	I.D. *	0.001
Cadmium	I.D. *	0.004
Mercury	I.D. *	0.0015
Nickel	I.D. *	0.090

* ID = Insufficient Data

WESTSIDE

TOTAL ANNUAL MASS DISCHARGE OF LEAD VS. OVERFLOWS PER YEAR

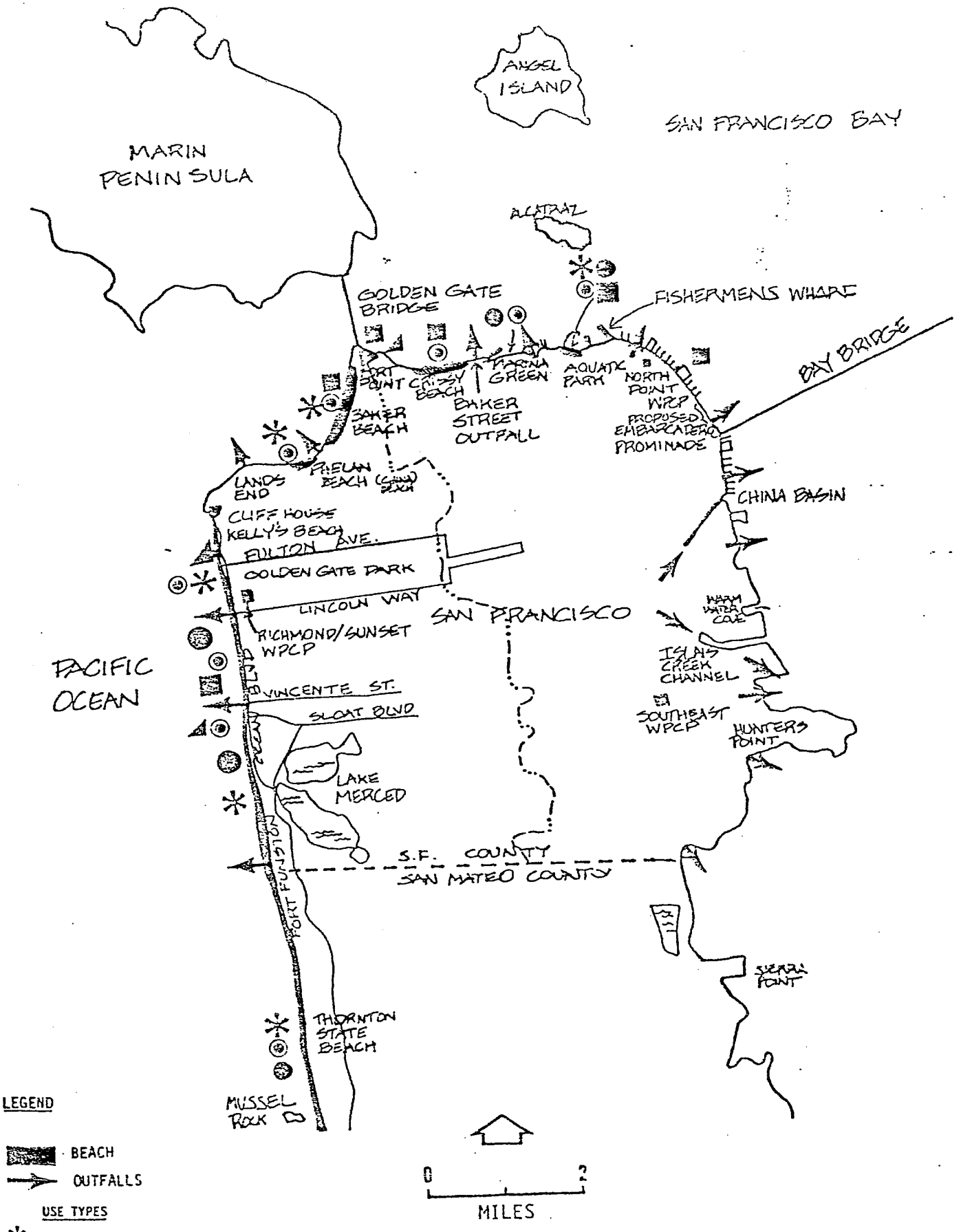


a) In Case #1 it was assumed that dry weather treatment provided 75% removal of lead and wet weather treatment provided 30% removal of lead.

b) In Case #2 it was assumed that both wet and dry weather treatment provided 75% removal of lead. In both cases overflow was assumed to provide 0% removal. CAP = Chemically assisted primary.

c) Assumes Dry-weather upgraded to 75% removal.

Figure V-1



SHORELINE LENGTH	(MILES)
S.F. COUNTY LINE TO CLIFF HOUSE	= 4.8
CLIFF HOUSE TO G.G. BRIDGE	= 3.6
G.G.BRIDGE TO FISHERMEN'S WHARF	= 3.35
FISHERMEN'S WHARF TO BAY BRIDGE	= 2.2

13.95

FIGURE V-2 BEACH USE AND OVERFLOW LOCAT

SECTION VI

Cost-Benefit Analysis

Traditionally cost benefit analysis in sanitary engineering has focused on coliform, suspended solids (ss), BOD_5 (a measure of oxygen demanding material, and nutrients. Costs versus overflows versus benefits (% reduction in discharge due to overflows and days of coliform levels greater than 10,000 and 1000 MPN) are tabulated in Table VI-2. Table V-4 in the previous section provided a comparison of overflow frequency versus total Westside mass emissions (treated and treated) for lead, the metal of perhaps greatest concern during wet weather conditions. Cost benefit analysis based on emissions, while useful, have a limitation in that they do not provide any measure of what is happening in the receiving waters thereby making the real benefits of the reduction in overflow very difficult to establish

For example the intermittent discharge of suspended solids and BOD_5 into the surf zone of the Pacific Ocean probably has no great significance as wave action would be more than enough to prevent either sludge accumulation or depressed dissolved oxygen levels from occurring. The receiving water benefits, in terms of reduced long-term concentrations, that would be achieved by the reduction in the discharges of heavy metals and trace organics discharged through overflows would be difficult if not impossible to establish.

Therefore the discussion of costs versus benefits will focus on the reduction in the number of overflows (esthetics degradation)

and the number of days that receiving water coliform concentrations exceed acceptable levels (public health implications). As noted in Figure VI-1 the slope costs curves (both capital and equivalent annual) have a change in slope in the area between 6 & 12 overflows. This area of the curve which is centered at approximately 8 overflows per year best represents the 'knee of the curve' marginal costs-marginal benefit analysis required by the EPA funding guidelines (PGM-61). Table VI-4 Cost Benefit Analysis Based on Recreational Beneficiaries confirms this 'knee of curve'. As indicated the cost per beneficiary (a beach user that enjoys cleaner beaches and receiving water) is $31 per individual resulting from the reduction in overflows from 16 to 8 per year. The costs per beneficiary jumps dramatically to $167 per individual as overflows are further reduced to 4 per year and further increase to $222 per individual between 4 and 1 overflow per year. Recent discussions between Wastewater Program officials and EPA officials in Washington indicate that the EPA is very concerned about the high nationwide costs of wet-weather overflow control and would be perhaps unwilling to fund overflow control facilities beyond that indicated by the PGM-61 'knee of curves cost-benefit analysis.

Baffling

Much of the above listed material may float to the surface in the consolidation structure and could be trapped by a suspended baffle extending several feet below the water surface. A series of physical model tests were run to evaluate the feasibility of baffling. In October 1978 the evaluation of the floatable reduction efficiencies of suspended baffles was done on a 1.48 scale model of the proposed Westside Transport Facility. These tests indicated that a well-designed baffling system can result in a 70% to 95% or more reduction in floatables discharged.

Costs to install the baffle walls will run about $150 per linear foot of baffle wall. Assuming a total of 5,000 feet of baffle wall required for that project, costs for baffling will be approximately $750,000. This appears to be cost-effective and the decision has been made to proceed with implementation of this mitigating measure wherever feasible.

Screening

Because non-floatable sewage solids could underflow a baffle, we have evaluated the feasibility of screening. Roto-strainers (TM) were rejected from further consideration on the basis of high costs, hydraulic head requirements and uncertainties about their operational reliability under highly intermittent operations. Mechanically cleaned, treatment plant bar racks were rejected because of expense, uncertain operations and vertical clearance

problems under the streets or beach areas. Coarse racks, with clear spacing greater than 1 inch, probably have minimal potential for clogging. However, they would entrap little in the way of sewage solids, other than dead rats and sanitary napkins. Racks fine enough to trap tampon applicators (5/8") or cigarette filter tips (5/16") may be prone to serious clogging with a resultant loss of hydraulic capacity and the potential for upstream flooding of basements. There is a major concern as to whether the benefits derived will offset the costs and potential for upstream flooding.

Because of the very real concern for flooding, we recommend that the decision on screening be deferred until such time as the project is completed and the effectiveness of the baffling can be evaluated. If the baffled flow still contains substantial quantities of objectionable sewage solids, then a test installation of various size bar racks could be retrofitted for evaluation.

Extended Outfalls

The City had the design consultants for the Southwest Ocean Outfall Project (SWOOP) prepare a feasibility study of an extended outfall for the Ocean beach area. This analysis was predicated on an assumed flow of 1,100 CFS (cubic feet per second), which is the rate approximating the one-year peak hourly overflow in the westside system. (This rate is very preliminary and is subject to revision). The conclusions reached by this 'desk top' study are as follows:

1. The Lincoln Way site appears to be a better location than

the Vicente Street site for a short outfall.

2. The 3,000-foot long outfall is a better length than a 1,000 or 5,000-foot long outfall.

3. Gravity flow can be obtained in an outfall system consisting of:

   - o A single conduit 15 feet in diameter or a double pipe 11 feet in diameter;
   - o A 660-foot long diffuser perpendicular to the predominant current;
   - o Four risers 8 feet in diameter;
   - o Thirty-two ports, each 2 feet in diameter (eight ports per riser)

4. An average initial dilution of 10:1 can be obtained.

5. The plume may surface or remain submerged depending upon the stratification of the receiving water.

6. The wastefield has a low probability of reaching shore.

7. The construction, operation and maintenance of the intermittent flowing outfall will be more difficult and present more risk than the SWOOP wet weather outfall. Generally any site this close to shore is exposed to problems caused by severe bottom movement, sediment suspension, wave action, etc. While the outfall probably can be designed, constructed and maintained at this site, it must be realized that maintenance problems will occur.

Schematics and expected performance data are shown on Figures VII-1 to VII-4 and Table VII-1. Costs for this proposal are estimated at $36,000,000 (1978 costs-includes 35% mark-up for headworks, design and construction engineering contingencies etc.) Operation & Maintenance costs are unpredictable but could be considerable as underwater maintenance problems will occur and underwater maintenance work is expensive.

Disinfection of Overflows

The feasibility of disinfection was evaluated assuming treatment plant performance objectives and separate contact basins. This proved not to be feasible because of the extensive volume of the required contact basins needed to achieve the desired 30-minute contact time. An alternative approach would be to utilize the Westside Transport structure proper as the contact chamber. An evaluation of this alternative requires the assumption of the following:

1. The volume of water to be treated ranges from 0 to 700 MGD (1 year overflow rate) and is totally dependent on the weather.

2. The City is committed to using liquid sodium hypochlorite for disinfection until a more cost effective alternative is developed during ongoing studies.

3. The wet weather disinfectant demand is variable and nearly impossible to predict in advance.

4. Dechlorination by sodium bisulfite will be necessary to eliminate the toxic effects of chlorination.

5. Thirty minute contact time is necessary for effective disinfection.

6. A central chemical storage side is used.

The science of properly disinfecting wastewater discharges is complicated by the fact that there is no reliable means by which to predict the quantity requirements of the selected disinfectant. In the case of Westside wet weather discharges, the problems which must be overcome to adequately achieve the desired effect (elimination of pathogenetic organisms) is complicated by the following:

1. Disinfection chemicals must be on hand at all times to treat the "worst case" requiring year round storage of large quantities of disinfectant. In the case of sodium hypochlorite, this chemical deteriorates with time reducing its effectiveness and is not always commercially available on short term demand.

2. Disinfection dosage is usually controlled by wastewater flowrate and demand is determined by periodic analysis. In the case of an overflow, demand cannot be quickly determined and serious overdoses or underdoses may occur due to improper control. Both situations incur undesirable results, underdosing meaning inadequate disinfection requirements and overdosing, release of toxic materials to the aquatic environment.

3. Dechlorination facilities require as careful design as chlorination facilities and due to the lack of control of effluent flow, disinfectant dosage could be subject to severe dosage control problems thereby negating its intended purpose i.e. eliminating chlorine residual.

4. The cost of chlorination and dechlorination chemicals is high and if they are not applied efficiently would result in a wasteful practice.

5. Storage of large quantities of chemicals which would require replenishment in the westside area may cause problems due to delivery by large vehicles.

6. On a theoretical basis the volume of the structure is sufficient to provide a 59-minute contact time for the one-year design flow. However, the storage transport system is not designed as an efficient contact basin and considerable short-circuiting will occur due to the multiple inflow and outflow points. It may be possible to do some baffling to eliminate the most severe short-circuiting problems while retaining acceptable hydraulic transport operation. Even so, the assumption must be made that considerable short-circuiting would still exist and a significant percentage of the flow would receive for less than adequate contact time.

7. The only practical way to inject the disinfectant would be in the influent sewers several hundred feet upstream of the consolidation structure. As there are six major influent

sewers distributed along a 8-mile length of the total westside system, at least 8 miles of piping from a central disinfectant distribution station would be required.

8. The performance of any such system to disinfect combined sewer flows is open to question. The fact that much of the flow would receive less than adequate contact time coupled with difficulties in establishing proper dosage rate could result in very poor performance as far as kills of highly resistant viruses especially hepatitis.

Due to uncertainties about the performance of this system, the considerable operational headaches attendant with the multiplicity of injection points, the fact that available public health statistics suggest that combined sewer overflows are not presently a serious public health problem, it is our conclusion that disinfection is not a viable mitigating measure.

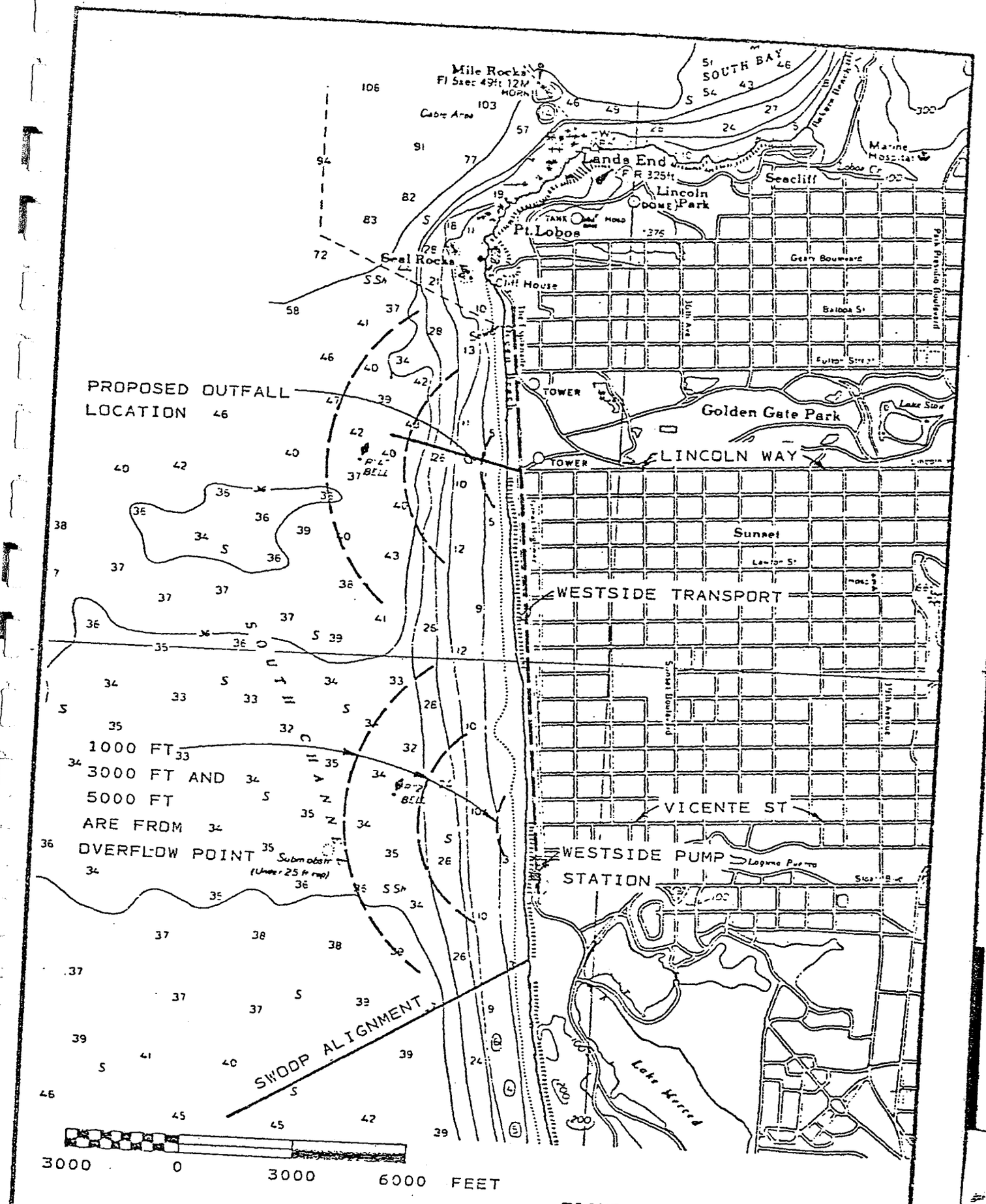


FIGURE 1
VICINITY MAP
REVISED OVERFLOW CONTROL STUDY

SOUNDING IN FEET BELOW MLLW

CH2M HILL

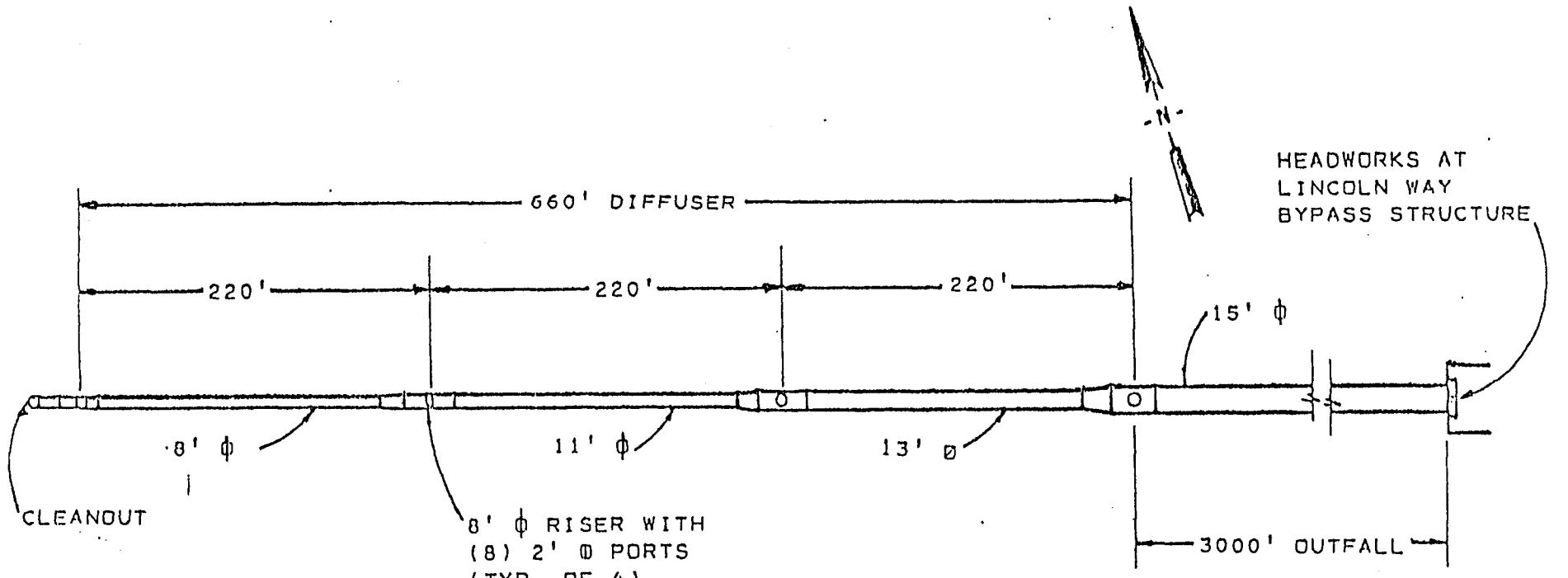


FIGURE 10
PLAN VIEW OF OUTFALL
REVISED OVERFLOW CONTROL STUDY

CH2M HILL

Figure VII-2

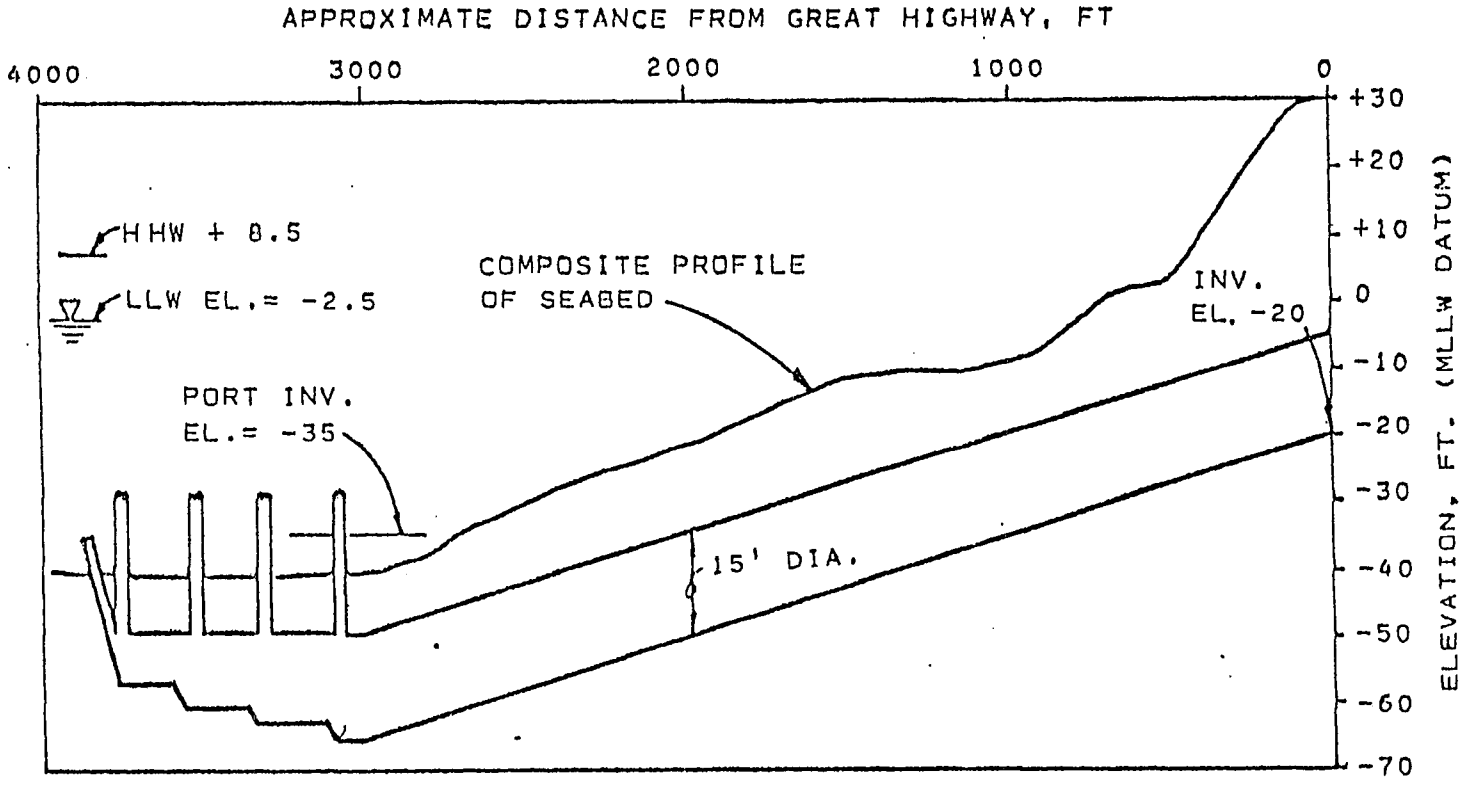
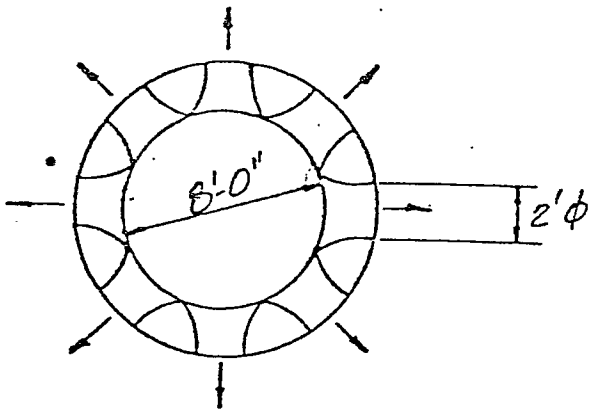
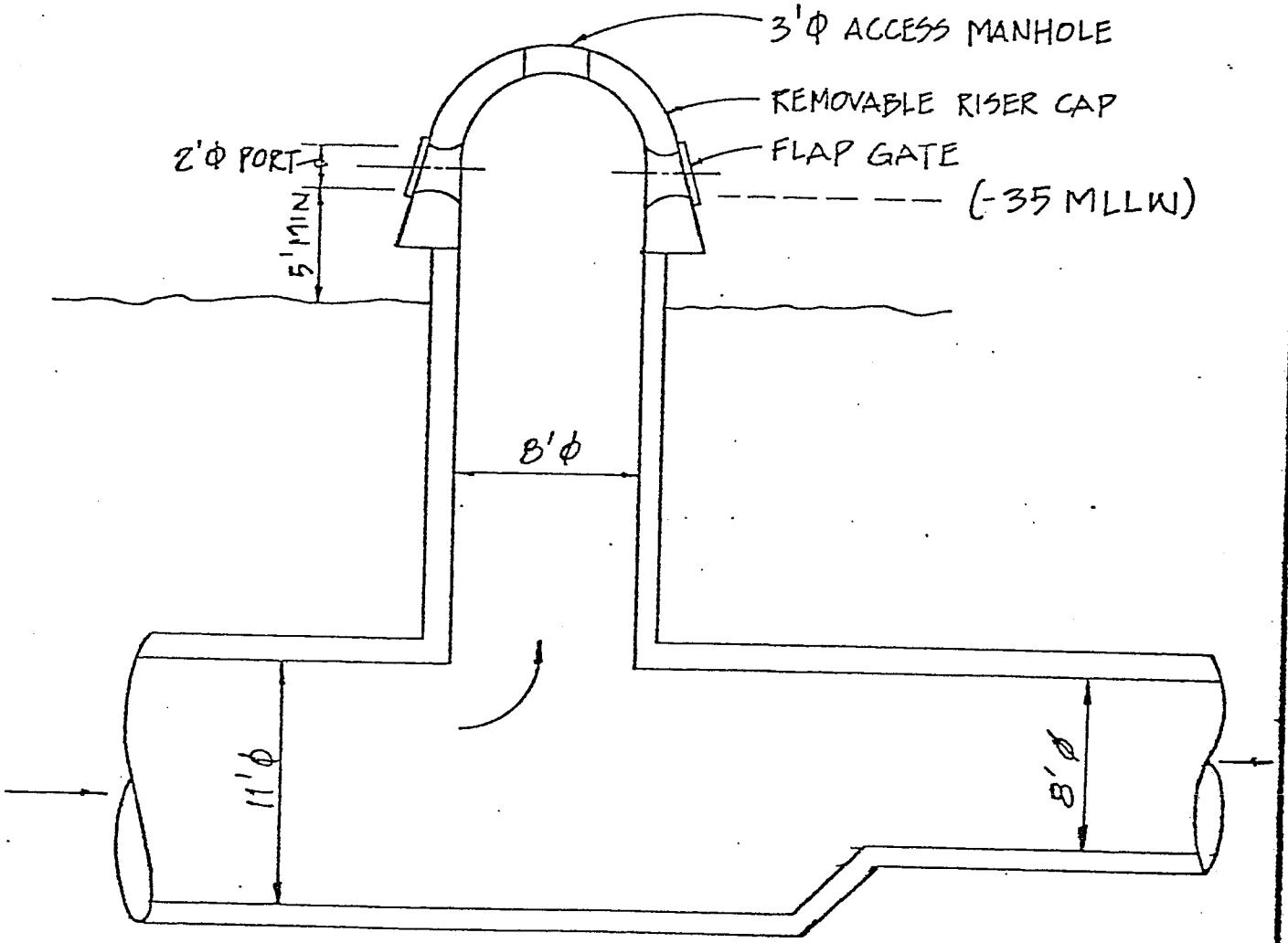


FIGURE 9
PROFILE OF OUTFALL
REVISED OVERLOW CONTROL STUDY

CH2M HILL



PLAN THROUGH PORTS
NO SCALE



SECTION
NO SCALE

FIGURE 11
DIFFUSER RISER
REVISED OVERFLOW CONTROL STUDY

CH2M HILL

EXPECTED OUTFALL PERFORMANCE

WINTER STORM CONDITIONS - SURFACING DISCHARGE

Initial Concentration (counts/100 ml)	Time After Discharge (hours)	Initial Dilution Factor	Subsequent Dilution Factor	Total Dilution Factor	Bacterial Decay Factor	Total Reduction Factor	Final Concentration (counts/100 ml)	Probability of Reaching Shore (% of time during all discharge events)
3×10^6	6	$.704 \times 10^{-1}$	$.266 \times 10^{-0}$	$.187 \times 10^{-1}$	$.326 \times 10^{-0}$	$.611 \times 10^{-2}$	18,300	.1
3×10^6	12	$.704 \times 10^{-1}$	$.124 \times 10^{-0}$	$.873 \times 10^{-2}$	$.106 \times 10^{-0}$	$.930 \times 10^{-3}$	2,790	.5
3×10^6	18	$.704 \times 10^{-1}$	$.740 \times 10^{-1}$	$.521 \times 10^{-2}$	$.313 \times 10^{-1}$	$.163 \times 10^{-3}$	489	.5
3×10^6	24	$.704 \times 10^{-1}$	$.510 \times 10^{-1}$	$.359 \times 10^{-2}$	$.897 \times 10^{-2}$	$.322 \times 10^{-4}$	96	.5

WINTER STORM CONDITIONS - SUBMERGED DISCHARGE

Initial Concentration (counts/100 ml)	Time After Discharge (hours)	Initial Dilution Factor	Subsequent Dilution Factor	Total Dilution Factor	Bacterial Decay Factor	Total Reduction Factor	Final Concentration (counts/100 ml)	Probability of Reaching Shore (% of time during all discharge events)
3×10^6	6	$.833 \times 10^{-1}$	$.265 \times 10^{-0}$	$.221 \times 10^{-1}$	$.321 \times 10^{-0}$	$.709 \times 10^{-2}$	21,270	<.1
3×10^6	12	$.833 \times 10^{-1}$	$.124 \times 10^{-0}$	$.103 \times 10^{-1}$	$.103 \times 10^{-0}$	$.106 \times 10^{-2}$	3,180	<.1
3×10^6	18	$.833 \times 10^{-1}$	$.739 \times 10^{-1}$	$.616 \times 10^{-2}$	$.291 \times 10^{-1}$	$.179 \times 10^{-3}$	537	<.1
3×10^6	24	$.833 \times 10^{-1}$	$.510 \times 10^{-1}$	$.425 \times 10^{-2}$	$.798 \times 10^{-2}$	$.339 \times 10^{-4}$	120	<.1

Table VII-1

SECTION VIII

CONCLUSIONS

- The differences in costs between the eight overflow per year frequency being requested by the City and the one overflow per year frequency currently mandated by the NPDES permit appears to be out of proportion to the derived benefits. The higher degree of control would result in only 21 additional days of acceptable water bacteriological quality per year. It is estimated that 165 people per day during these 21 days would be swimming or surfing in the area impacted by North Shore overflows. Based on the difference in annual cost this additional protection costs over $2886 per individual per day that would enjoy this protection.

- With the exception of bacteriological emissions, existing wet-weather overflows constitute less than 1% of the total mass emission loadings into the Bay and adjacent ocean area. Therefore, even complete elimination of all city-wide combined sewer overflows is unlikely to result in a measurable region-wide improvement in water quality.

- Notwithstanding the dramatic increase in nearshore receiving water coliform levels following overflows, the existing public health problem appears minimal. Information received from the City's Department of

Public Health - Bureau of Disease Control indicates that they can find no documented cases in the past 25 years of serious disease resulting from contact with Bay or Ocean waters. Serious disease resulting from bathing in fecally contaminated water is in general not a major public health problem in the United States. According to an article in the June, 1978 issue of the Journal of the Water Pollution Control Federation, there was only one reported outbreak of disease in the United States in 1977 resulting from swimming in fecally contaminated water.

- The short-term measurable adverse impacts of overflows consist of possible degradation of the aesthetic qualities of nearby beaches and increases in the coliform levels and presumably increased pathogens and viruses in the nearby waters. These impacts are essentially confined to the San Francisco shoreline, the northerly two miles of the San Mateo shoreline and possibly on occasion Alcatraz Island.

- Of the four mitigating measures investigated, only baffling of overflows appears to be cost-effective and warrants implementation at this time. Extended outfalls do not appear to provide benefits consistent with the considerable costs and potential for serious maintenance problems and the other two measures, - disinfection and screening - have serious operational uncertainties and

cannot be recommended at this time.

- The present level of control mandated by NPDES permit, 1 overflow per year average, will result in the treatment of 99.5% of the total waste water treated. The revision of the control level to an average of 8 overflows per year will result in treatment of 95.9% of the total wastewater. This breaks down to 99.6% of all sanitary flow and 86 percent of all urban runoff will be treated. By being able to provide some treatment to a high percentage of the urban runoff, San Francisco's combined sewer system that has been frequently described as 'antiquated' would actually be providing greater protection to the environment than a purely separate system.

APPENDICES

APPENDIX A

CITY AND COUNTY OF SAN FRANCISCO

DEPARTMENT OF PUBLIC HEALTH

CENTRAL OFFICE
101 GROVE STREET
SAN FRANCISCO, CALIFORNIA 94102

ENTERIC DISEASE INCIDENCE - SAN FRANCISCO - 1964-1978
Prepared in San Francisco Department of Public Health
16 November 1978

In 25 years of records in the Bureau Of Disease Control, there are no documented laboratory- or clinically-confirmed cases of shigellosis, salmonellosis, or hepatitis A produced by direct contact with shoreline waters or by ingestion of raw bivalves in San Francisco. These three diseases, all reportable by law, are of particular interest in examining the potential role of recreational waters with high coliform count, or marine life from such waters, as possible source of diarrheal diseases (enteric infection) in San Francisco. These diseases are contracted by swallowing the infecting organism. Disease incidence records for diarrheal disease reported in the City from 1964 to the present are attached. Prior to 1967, much of the diarrhea was caused by shigella sonnei, a swallowed bacterium; it produced laboratory- or physician-confirmed reports of diarrhea primarily among the residents of the Spanish ethnic community in the City, more commonly among children than adults, with an annual incidence peak in July-September. Where the source could be determined, most of the cases were traced to food-borne transmission, occasionally in a local restaurant, but more commonly by members of the family household who were found to be fecal carriers who prepared meals for the family. During this period, salmonellosis, the other common bacterial cause of diarrheal disease, was reported at a low constant rate of 100-150 cases per year.

In 1967-68, during the Haight-Ashbury period, the incidence of reported cases of shigellosis did not change significantly, possibly due to insufficient medical care or transiency of the population in that area, but it did begin a slow rise thereafter, caused by a different strain of shigella. Hepatitis A, caused by swallowing of the hepatitis virus, increased very remarkably during these two years, and remained then at a high level. The rise was attributed to the multiple personal contacts of the crowded, unsanitary, commune-style living conditions in that area and among that population. (The incidence of salmonellosis, in contrast, did not increase. This difference, we believe, is due to a dose/response factor: 10-100 shigellae can produce diarrhea in a human, but it requires 10,000-1,000,000 salmonellae for the same effect.) At the low temperature and high salinity of shore waters, although the organisms could survive, they could not multiply. Laboratory conditions for successful culture require an appropriate nutrient broth or gel medium, and constant temperature of 35°C.(95°F.) for at least 48 hours.

After 1974, a secondary rise in incidence of shigellosis and hepatitis A was found in the expanding alternate life-style communities within the City. Variously, in 75% to 92% of such patients on whom valid histories could be obtained, transmission was found to be by direct intimate personal or household food contact. There is no significant seasonal variation in the incidence of shigellosis, salmonellosis, or hepatitis A as reported in the City since the Haight-Ashbury summers.

Since the first appearance in the literature of reports of ingestion of raw shellfish as a source of possible infection with hepatitis A virus, Department staff have made inquiry on this point from appropriate patients, without confirming cases of such transmission. Although other bivalves could also theoretically concentrate and transmit the hepatitis virus, the local mussels, shrimp, clams, and crab are usually cooked before eating, and the virus would be expected to be destroyed or inactivated in the process. In 25 years of records in the Bureau of Disease Control, there are no documented laboratory- or clinically - confirmed cases of shigellosis or hepatitis A produced by direct contact with shoreline waters or by ingestion of raw bivalves in San Francisco.

Approved:

Mervyn F. Silverman, M.D., M.P.H.
Director of Public Health

Prepared by:

Selma K. Dritz, M.D., M.P.H.
Assistant Director
Bureau of Disease Control
and Adult Health

REPORTED CASES - SELECTED CAUSES

SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

YEAR	SHIGELLOSIS	SALMONELLOSIS	HEPATITIS A
1964	76	104	150
1965	81	99	181
1966	71	118	204
*1967	69	119	552
*1968	48	121	819
1969	144	140	651
1970	85	142	723
1971	159	171	767
1972	254	139	542
1973	208	122	696
1974	189	110	480
**1975	346	107	647
**1976	602	161	912
**1977	325	143	690
**1978 (9 months)	320	110	472

* Haight-Ashbury Period
** Expanded Alternate Life-Styles Period

APPENDIX B

TABULATIONS AND GRAPHS FOR SELECTED DISEASES REPORTED IN SAN FRANCISCO

DESCRIPTION OF SOURCE MATERIALS

From the files of the San Francisco Department of Public Health, Bureau of Disease Control, we present the following month-by-month incidence of laboratory-confirmed cases of shigellosis and salmonellosis, respectively, as reported in San Francisco for five selected years, in a resident population of roughly 700,000. Records are gathered chiefly from laboratory reports and physicians' Confidential Morbidity Reports, both legally required by order of the California State Board of Health, (see Attachment A) and from other sources, such as Departmental inspectors of food establishments, school nurses and teachers, field public health staff, and local citizens. From 3 to 5% of the patients are residents of other counties or states, diagnosed and reported from medical centers in the City, and therefor recorded as San Francisco cases. Though not all physicians file reports as required, the resulting discrepancy is a constant one throughout the year, and does not affect the configuration of the incidence curves. Disease incidence reports are compared for wet, dry and normal years, both prior to, (1964 and 1967) and following (1973, 74 and 77) the intensive drive by the Department to obtain more complete reporting of disease incidence from physicians. Tabulations which we submitted in a prior release were supplied from the Bureau of Statistics of the Department of Public Health,

and are based on the date of receipt of the report. In those tables, some cases which developed late in the year were diagnosed and reported in the following year. But the graphs which are shown here are taken from abstracts of patient histories recorded in the files of the Bureau of Disease Control, and are based on actual date of onset of symptoms. These, therefor, have slightly different annual totals for the selected years than the previous tables. We chose to show incidence of shigellosis, because it is caused by the most frequently identified enteric bacterial pathogen in San Francisco, and one which readily causes disease symptoms with swallowing of a minimal dose (10 to 100 organisms). We show incidence of salmonellosis because it is caused by the hardiest enteric bacterial pathogen, although it requires a much larger dose (10^4 to 10^6 organisms). We do not show incidence of hepatitis A in these exhibits, because we have not, as yet, a readily available laboratory method for definitive identification of the hepatitis A virus.

Analysis of graphs and tables

Data were compared for wet, normal and dry rainfall years. The years 1964 and 1967 were, respectively, wet and normal rainfall years prior to a massive effort by the SFDPH to improve reporting of communicable diseases, as required by State law, by physicians in the community. The years 1973 and 1974 were, respectively, wet and normal rainfall years after the reporting had improved, and numbers of recorded cases subsequently increased. The increase was compounded by development of a large, persistent

outbreak of enteric (diarrheal) disease resulting from increased household and direct personal transmission of the infecting organisms, without relation to water sports or ingestion of shellfish. The year 1977 was the most recent drought year.

None of the monthly variations in incidence reports were significant numbers in a population of 700,000. If any comment were made on the small seasonal variations in incidence reports, it would be to note that most of the small increases were recorded during the summer months, when little or no rain falls on the City.

Cabelli et al, in 1976, reported a perspective study done for EPA, on pollution effects on swimmers at two New York beaches. They found that symptoms of fever, headache, diarrheal disease, developed within 10 days of swimming at Coney Island Beach, "a barely acceptable (polluted) one," in 3-4% of swimmers, while the incidence of such symptoms was significantly lower at Rockaway Beach nearby, "a relatively unpolluted one". At both beaches, they found a higher incidence of these symptoms in swimmers, as compared to non-swimmers. The authors did not state the numbers of persons in the water at either of the beaches on the days of their study.

We must point out that the symptoms which they described, and ascribed to the ingestion of various enteric bateria, which they found at elevated levels on those days at those sites (particularly total coliforms), are also the symptoms that are produced by infection with enteroviruses; these enteroviruses are frequently

cultured from human urine samples in cases of illness marked by the same symptoms as those described in their paper. If the total population in the water were as high as perhaps 100,000, which is not uncommonly reported from Coney Island Beach on a hot day in summer, the concentration of human urine from direct urination in the water, and potential for high viral concentration in the beach shallows, could be, and probably was, considerable. It is my opinion that the probability of developing enteric disease from ingestion of urinary enteroviruses at those beaches in summer is very much greater than that of infection by fecal organisms.

Such a situation is not comparable to beach conditions in San Francisco. If 1000 or even 2000 persons could be found in the water on a particularly hot day, the concentration of urine in the turbulent shore waters would be almost nil. A similar situation might be postulated for Aquatic Park swimming area by the very small number of persons who actually swim in those waters.

State Department of Public Health, (S. B. Werner, MD), report that no cases are known in their files that confirm enteric disease acquired in recreational waters or by ingestion of shellfish from the Bay Area waters, except for PSP (paralytic shellfish poisoning) from mussels taken during forbidden periods of May through October in this area.

State Fish and Game (Walter Dahlstrom) report that shellfish checked for concentration of heavy metals and a variety of pesticides indicate no public health problem from these substances.

Their concern would be aroused only by elevated coliform counts during periods of high runoff in winter storms.

LAWRENCE LAB BAY AREA SHELLFISH AND SEDIMENT STUDY - PLUS JONES AND STOKES EPA 1977

RECOMMENDATIONS AND FDA PROPOSED STANDARDS

Element	Average Daily uptake	Normal body levels	Lawrence lab findings	Jones & Stokes
Ag	na	na	Elevated So. Bay shellfish	no standards
As	na	na	na	no standards
Cd	15-35 ug	1 ug/gm wet tissue	3ppm Tara Hills. Coypte Pt. No., Foster City	0.5 ppm ss clam 1.5 oysters. So. 3.5 oysters. No.
Co.	0.1 ug (B12?)	80-300uug. blood	na	na
Cr.	na	6 mgm total body	na	5 ppm ss clam 2 ppm oysters
Cu	2.5-5 mgm	100 ug/100 ml blood	na	25 ppm ss clam 42 oysters So. 175 oysters No.
Fe	18 mg.	70-18- ug/100 ml serum	na	na
Hg	na	na	safe levels found	0.5 ppm*
I	100 ug	20-35 ug/100ml plasma	na	na
Mg	na	na	na	na
Mn	3-9 mgm, 40% absorbed	2.5 ug/100 ml plasma	na	na
Mo	na	0.1-3 ppm, total body	na	na
Ni	na	na	na	na
Pb	?.20 mgm???-5-10% absorbed?	child: 30ug/100ml bld adult: 60ug/100ml bld	safe levels except Albany Hills & Bayview Park	5 ss clam 2 oysters
Se	? Vit E?? Cystic fibrosis?	0.22 ug/100ml Blood	na	na
Zn	10-15 mgm, 30% absorbed	900 ug/100ml blood	na/	30 ss clam 1000 oysters So., 2000 oysters No.

DDT)
Chlorinated hydrocarbons) all levels safe and acceptable
Organophosphates ??)

* New FDA standard is 1.0 ppm

REGULATIONS OF THE CALIFORNIA STATE BOARD OF PUBLIC HEALTH FOR THE CONTROL OF COMMUNICABLE DISEASES †

GENERAL SECTIONS

2500. *Reporting to the Local Health Authority.* It shall be the duty of every physician, practitioner, dentist, coroner, every superintendent or manager of a dispensary, hospital, clinic, or any other person knowing of or in attendance on a case or suspected case of any of the following diseases or conditions, to notify the local health authority immediately. A standard type report form has been adopted and is available for this purpose.

*Amebiasis
Anthrax
Botulism
Brucellosis (Undulant Fever)
*Chancroid
Cholera
*Coccidioidomycosis
*Conjunctivitis, Acute Infectious of the Newborn (Gonorrheal Ophthalmia, Ophthalmia Neonatorum, and Babies' Sore Eyes in the first 21 days of life)
Dengue
Diarrhea of the Newborn
Diphtheria
Disorders Characterized by Lapses of Consciousness
Dysentery, Bacillary (see Shigella infections)
Encephalitis, viral
Food Poisoning (other than Botulism)
*German Measles (Rubella)
*Gonococcal Infections
*Granuloma Inguinale
Hepatitis, Infectious
Hepatitis, Serum
Leprosy (Hansen's Disease)
Leptospirosis (including Weil's Disease)
*Lymphogranuloma Venereum (Lymphogranuloma Inguinale)
Malaria
*Measles (Rubeola)
Meningitis, Viral
Meningococcal Infections
*Mumps
Paratyphoid Fever, A, B and C (see Salmonella infections)
*Pertussis (Whooping cough)
Plague
Poliomyelitis, Paralytic
Psittacosis
Q Fever
Rabies, Human or Animal
Relapsing Fever
*Rheumatic Fever, Acute
Rocky Mountain Spotted Fever
*Salmonella Infectious (exclusive of typhoid fever)
*Scarlet fever
*Shigella Infections
Smallpox (Variola)
*Streptococcal Infections, hemolytic (including Scarlet Fever, and Streptococcal Sore Throat)
Syphilis
Tetanus
*Trachoma
Trichinosis
Tuberculosis
Tularemia
Typhoid fever, cases and carriers
Typhus fever
Viral Exanthem in Pregnant Women
Yellow fever

For outbreak reporting and reporting of occurrence of unusual and rare diseases see Sections 2502 and 2503.

2501. *Reports by Local Health Officer to State Department of Public Health.* (a) Individual case reports. Each local health officer shall report at least weekly, on the prescribed form, to the Director of the State Department of Public Health each individual case of those diseases or conditions not marked with an asterisk (*) in the above list (Section 2500), which have been reported to him in the last seven days.

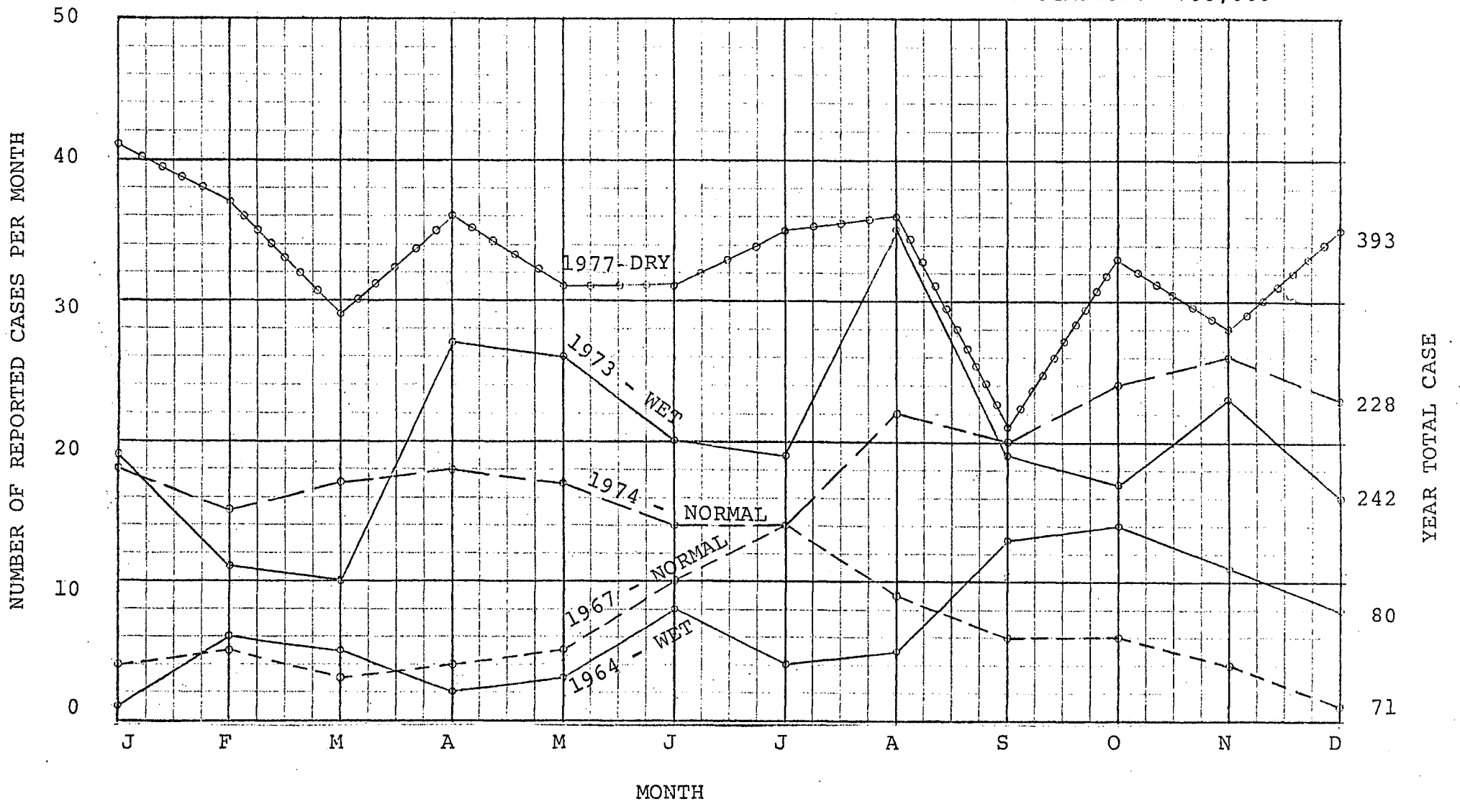
† From California Administrative Code, Title 17, Public Health.
* See Section 2501.

Attachment A

SHIGELLOSIS CASES REPORTED - SAN FRANCISCO

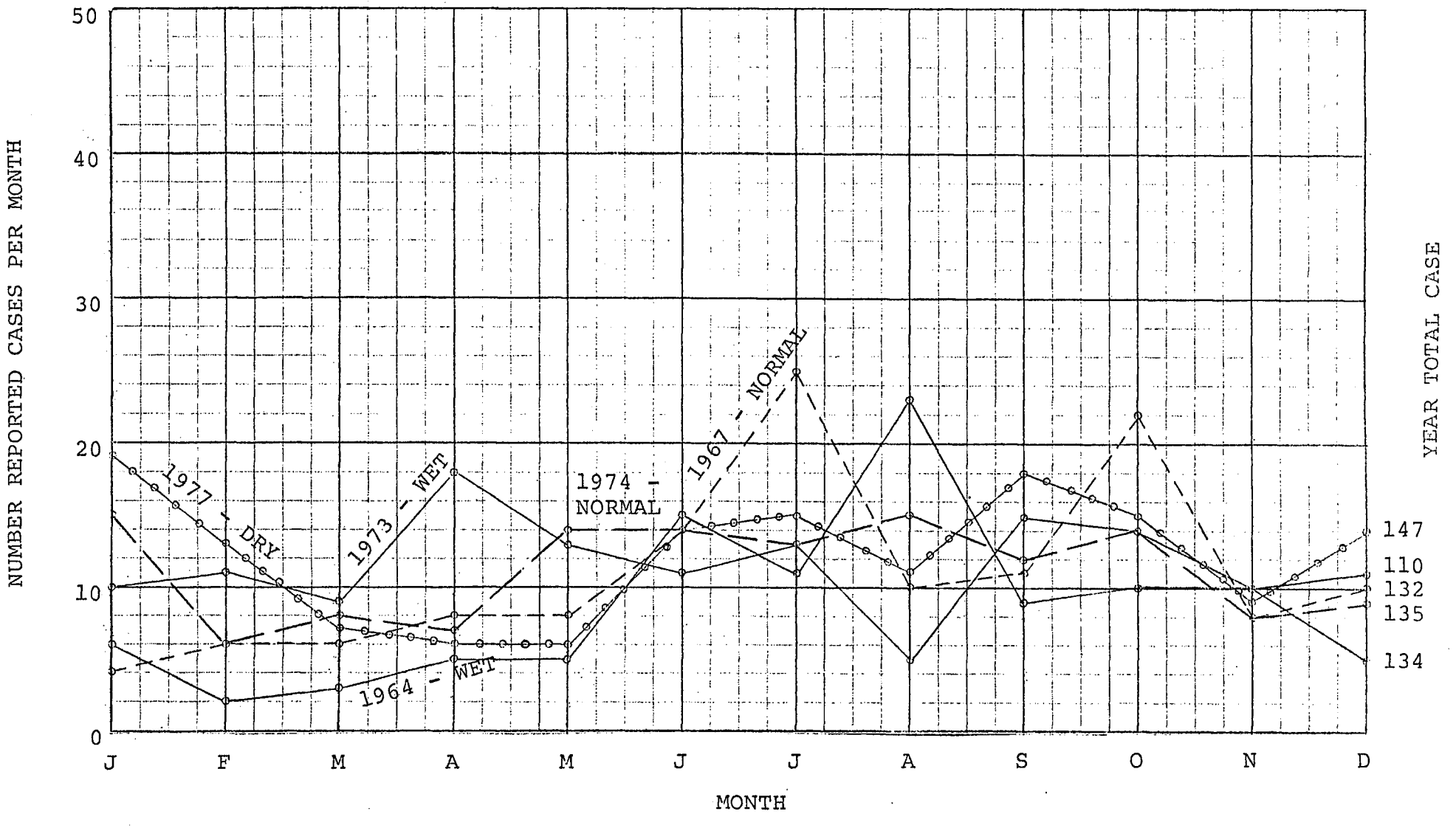
SELECTED YEARS

POPULATION: 700,000



SALMONELLOSIS CASES REPORTED - SAN FRANCISCO
SELECTED YEARS

POPULATION: 700,000



DEPARTMENT OF HEALTH SERVICES
[illegible] BAY WAY
[illegible], CA 94704
(415) [illegible], Ext. 241

Appendix C

December 6, 1973

Selma Dritz, M.D.
Communicable Disease Control Officer
San Francisco City & County Health Department
101 Grove Street
San Francisco, California 94102

Dear Doctor Dritz:

NO REPORTS OF ENTERIC DISEASE IN SWIMMERS OFF THE SAN FRANCISCO COAST

In response to your request today for a written statement on this issue, let me say that the State's Infectious Disease Section has received no reports in recent years linking any enteric disease in individuals or groups of individuals to recreational use (swimming, surfing, boating, etc.) of waters in the immediate San Francisco area. This should not be construed to mean that there hasn't been any such disease .... only that none has been reported to us.

Potential disease does exist, however, not only from a theoretic point of view but as can be seen by published reports. But reports of disease from polluted recreational water are really quite rare. The major threat from such water comes from purposeful ingestion of the water or the consumption of raw or inadequately heated shellfish harvested from it. Nonetheless, reasonable efforts should be made to minimize the risk that San Francisco Bay waters may pose to the public's health.

Sincerely yours,

S. B. Werner, M.D.
Medical Epidemiologist
Infectious Disease Section

WESTSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

CONTROL LEVELS

Yearly O'flow Totals	Unit	Existing			16 per year			
		Min	Ave	Max	Min	Ave	Max	
No. of Overflows	Event	26	114	193	6	16	31	
% Reduction			Base			86		
Hours of Overflow	Hour	163	372	617	16	85	148	
% Reduction			Base			77		
Total Wastewater	Gal.x10^6	926	2,870	5,030	151	1,100	2,360	
% Reduction			Base			62		
Sanitary Discharge	Gal.x10^6	149	341	566	15	78	136	
% Reduction			Base			77		
Urban Runoff	Gal.x10^6	774	2,520	4,450	136	1,020	2,220	
% Reduction			Base			60		
Composition of Discharge (% Sanitary)	%		12			7.0		
Days Receiving Waster (near outfalls) coliform Levels exceed;								
(1) 10,000 MPN/100ml	Days	41	70	103	10	23	46	
% Reduction			Base			67		
(2) 1,000 MPN/100ml	Days	67	119	147	23	49	90	
% Reduction			Base			59		
BOD_5	lbs.x10^3	394	1,220	2,140	64	468	1,000	C_E =
% Reduction			Base			62		
Suspended Solids	lbs.x10^3	3890	12,100	21,200	635	4630	9,930	C_E =
% Reduction			Base			62		

Table VI-1

Alter w without Lake Merced & Richmond

CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SANITARY ENGINEERING

PROJECT: W-7 : WESTCORE SYSTEM DATE: 6/13/84

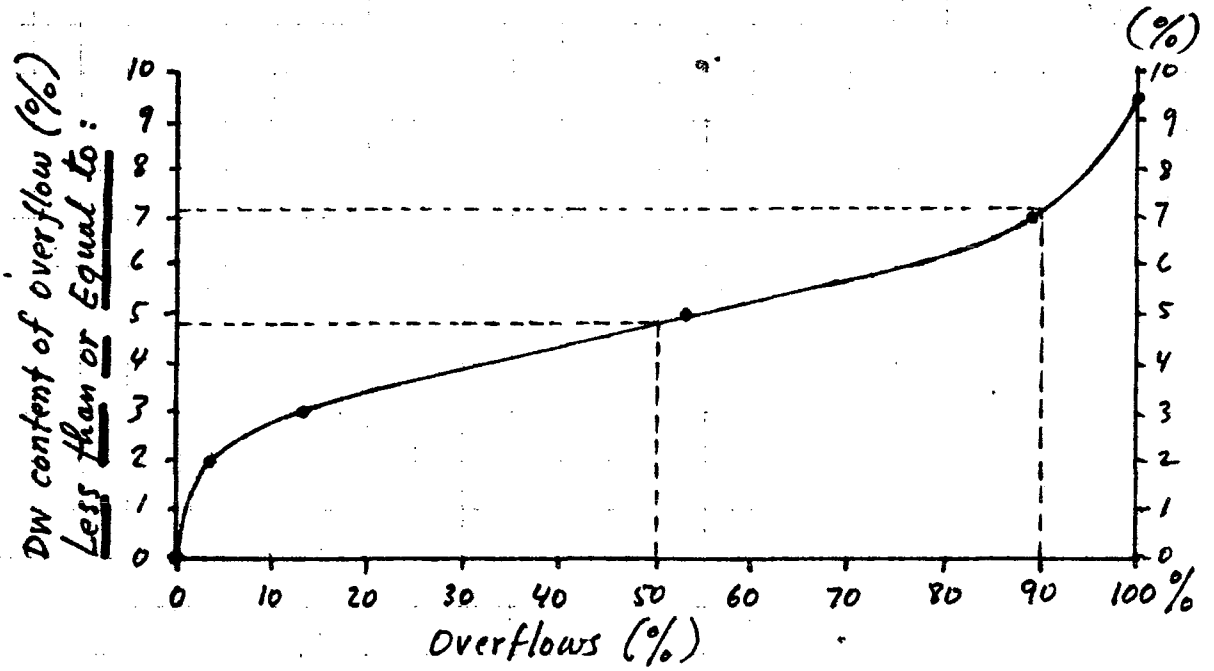
SUBJECT: QUALITY OF OVERFLOWS – REVISED PLOT FILE NO.:

PREPARED BY: C.A. Phanartzis SHEET 1 OF 1

The plot below shows the distribution of DW content versus overflows in percent, based on statistical analysis of hourly flows over a 70-year period.

Selected results of this analysis are summarized below:

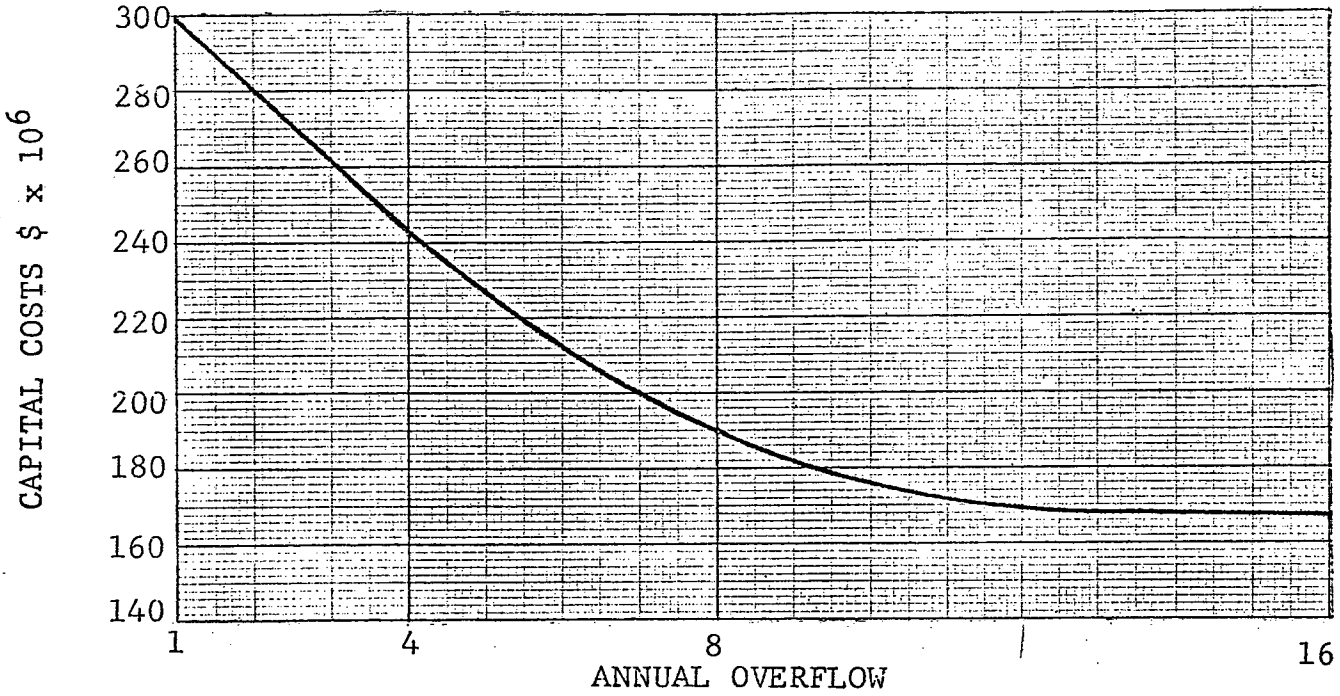
1. Long-term average DW content of overflows ≈ 5% by volume
2. Maximum single overflow DW content = 9.4% " "
3. Maximum hour within overflow DW content = 11% " "
4. Minimum " " " " " ≈ 1% " "
5. 90% of overflows have DW content ≤ 7.2% " "
6. 100% " " " " " ≤ 9.4% " "



BSE Form 1-3
(10/11/77)

WESTSIDE COSTS VERSUS OVERFLOW FREQUENCY

CAPITAL COST



EQUIVALENT ANNUAL COST

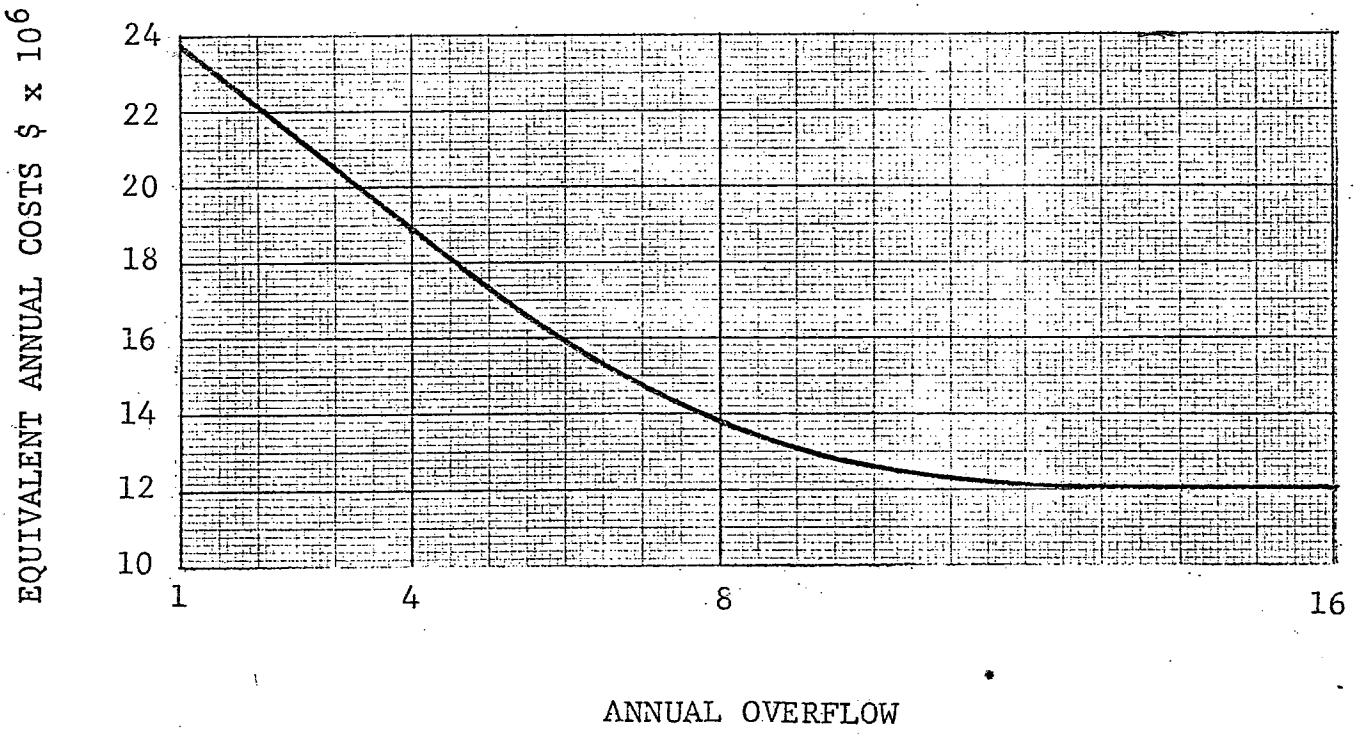


Fig. VI-1

WESTSIDE

STATISTICAL SUMMARY WET-WEATHER OVERFLOWS

(continued)

CONTROL LEVELS

Yearly O'flow Totals	Unit	8 per year			4 per year			1 per year		
		Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
No. of Overflows	Event	1	8	18	0	4	11	0	1	4
% Reduction			93			96.5			99	
Hours of Overflow	Hours	2	32	78	0	15.4	42	0	3.5	18
% Reduction			91			96			99+	
Total Wastewater	Gal.x10^6	15	449	1070	0	213	563	0	52	265
% Reduction			84			92.5			98	
Sanitary Discharge	Gal.x10^6	1.8	29	72	0	14	39	0	3.2	17
% Reduction			91.5			95.7			99+	
Urban Runoff	Gal.x10^6	13	420	998	0	198	524	0	49	248
% Reduction			83			92			98	
Composition of Discharge (% Sanitary)	%		6.5			6.5			6.2	
Days Receiving Waster (near outfalls) coliform Levels exceed;										
(1) 10,000 MPN/100ml	Days	2	10	23	0	6	16	0	1	6
% Reduction			86			91.4			98.6	
(2) 1,000 MPN/100ml	Days	6	25	51	0	13	31	0	4	14
% Reduction			79			89			96.6	
BOD_5	lbs.x10^3	6.4	191	460	0	91	239	0	22	113
% Reduction			84			92.5			98	
Suspended Solids	lbs.x10^3	63.1	1890	4550	0	896	2360	0	219	1,110
% Reduction			84			925			98	

Table VI-1 cont.

WESTSIDE

TABULATION OF OVERFLOWS VS COST VS ACCOMPLISHMENTS

No. of Overflows	COST ($ MILLION)		Susp. Solids & BOD % Reduction from Existing	Coliform				Overflow	
				> 10,000		> 1000			
	Capital	Annual		Days	% Reduction	Days	% Reduction	Hrs.	% Reduction
Existing	-	-	-	70		119		372	
16	$167	$12	62	23	67	49	59	85	77
8	189	14	84	10	86	25	79	32	91
4	242	19	93	6	91	13	89	15.4	96
1(NPDES)	299	24	98	1	99	4	97	3.5	99+

Table VI-2

WESTSIDE ZONE

WASTEWATER GENERATED AND PERCENTAGE TREATED

	Generated (Mill. Gal./Yr)	Percentage Treated				
		Existing	16 O'flows	8 O'flows	4 O'flows	1 O'flows
Sanitary	8040	95.8	99.02	99.63	99.82	99.96
Urban Runoff	3030	16.9	66.3	86.1	93.4	98.4
Total Wastewater	11070	74.1	90.1	95.9	98.1	99.53

Table VI-3

WESTSIDE COST-BENEFIT ANALYSIS

BASED ON RECREATIONAL BENEFICIARIES

Design No. of O'flows/yr	Days of coliform MPN >1000	Days		Annual Cost $x10^6	Cost Diff. $ x 10^6	Per Diem Costs x $1000		Cost($) per beneficiary	Incremental Costs($) Per Addtl. Beneficiary
		from exist	between levels			from exist	between levels		
EXISTING	119								
			70		12		171		68
16	49	70		12		171		68	
			26		2		77		31
8	25	94		14		149		60	
			12		5		417		167
4	13	106		19		179		72	
			9		5		555		222
1	4	115		24		200		80	

NOTES: A beneficiary is a beach user (includes swimmers and surfers) that enjoys cleaner water (i.e. coliform MPN 1000) as a result of the elimination of overflows.

2500 people per day assumed visiting beaches after overflows in the Westside zone between the Golden Gate Bridge and Thornton Beach (from Table V-1)